URAGAHALLI ESTATE

PLOUGHING SCENE.

YOUNG CANE.—NOTE THE MASONRY CONDUIT IN THE BACKGROUND.

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Some noteworthy Farms and Farmers of Mysore.

I.

The Uragahalli Estate and Farm of N. Krishnaiengar Esq., B.A., Jodidar of Uragahalli.

By the Editor.

It has been one of the aims of this Journal to publish in its pages accounts of the farming methods of some of the large and enterprising farmers of this State with a view to stimulate interest and a desire to copy and emulate among the other members of the Union. We are fortunate in being able to open this series of articles with an account of Mr. Krishnaiyengar's farm at Uragahalli ; for, who is there that is at all acquainted with the progress of agricultural improvements in Mysore who does not know that in his Farm in Uragahalli, Mr. Krishnaiengar has set an example to his fellow agriculturists not in Mysore alone but throughout India of what education, enterprise, intelligence and perseverance can do, when applied to agriculture ? For several years past the farm has been attracting visitors from far and near and from all classes of people from the humble agriculturist to the highest officers of the State ; these have seen and admired what Mr. Krishnaiengar has finally

achieved as the result of his enterprise. It has been our privilege however to have known and watched his efforts practically from the very commencement when twenty years ago now Mr. Krishnaiengar, a graduate in Science of the Madras University, well connected, and with a family tradition of Government service about him, took what no doubt many people should at that time have thought a very unwise step, by refusing to enter Government service and taking up the management of his Estate instead. We have watched him change the traditional time-honoured farming of the villlage into its present up-to-date form and build up step by step what was a broken-down place well on the road to the decay that most *Jodi* villages in the State are falling into, into the excellently appointed farm which it is at present. We are really thankful that Mr. Krishnaiengar has permitted us to write this brief narrative of the farm out of facts supplied by him : it has been by no means easy to persuade one of his nature to submit to the lime light of a magazine article, albeit in the interests of his fellow agriculturists.

Uragahalli village is situated about 24 miles from Bangalore ; about 20 miles is along the main Bangalore-Mysore Road ; and about 3 miles is along a cart track which branches off from the main road a mile beyond Bidadi. Bidadi on the Mysore Railway is the nearest railway station and is about 4 miles from the Estate.

The Uragahalli estate consists of the *Jodi* village of that name. The total arable area is about 760 acres, of which 650 acres are dry lands and the remaining 110 wet. Of this area 650 acres are let out to tenants on a permanent assessment and the *Jodidar* himself farms 110 acres consisting of 60 acres of wet land and 50 acres of dry land. It is this area of 110 acres which he keeps as his home farm and which he has developed greatly during the last 20 years. The wet area of 60 acres is all in one compact block and so is the dry land area of 50 acres. The wet land is commanded by two irrigation tanks of rather indifferent capacity. These tanks nevertheless constitute the most important source of irrigation. The larger one of these fills or has been known to fill once in three or four years ; the smaller ones however fill once a year. In addition to these tanks Mr. Krishnaiengar has constructed three large wells on the wet area from which water is pumped. These wells are not spring wells but form merely reservoirs of percolation and drainage water

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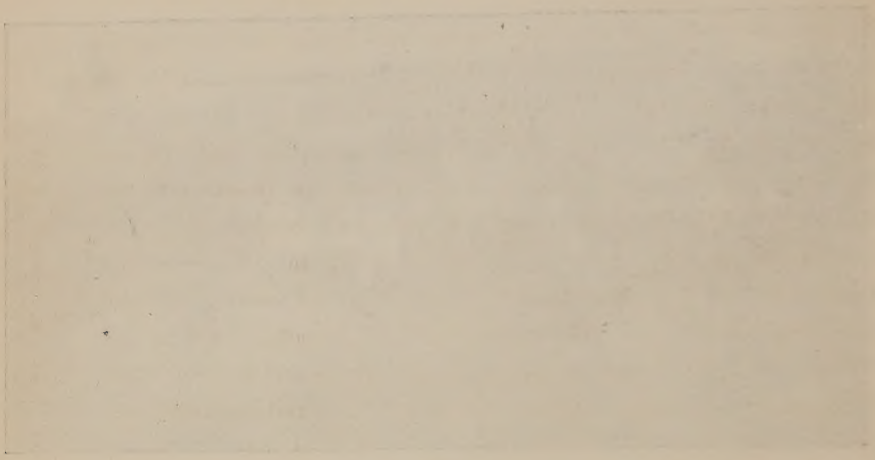
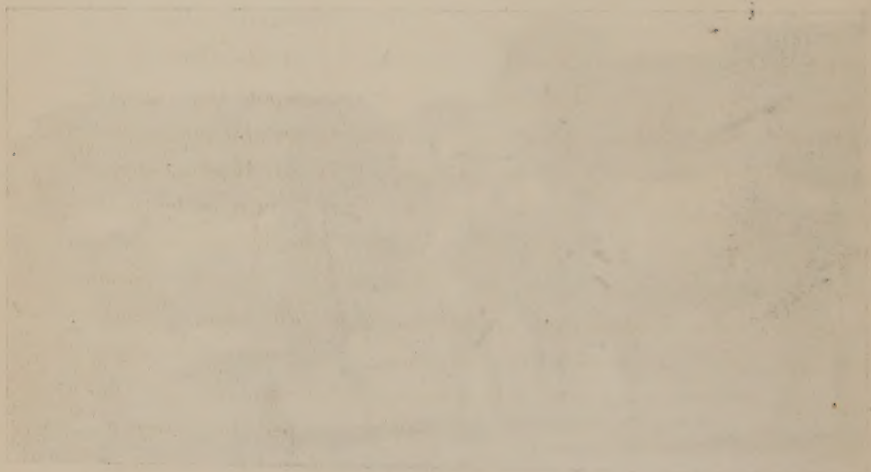
ONE OF THE DRAINAGE-*CUM*-IRRIGATION WELLS REFERRED TO IN THE TEXT, WITH PUMPING HOUSE.

YOUNG STOCK RAISED ON THE FARM.—NOTE THE MANY LARGE STACKS OF RAGI JUSTIFYING THE USE OF A POWER-DRIVEN THRESHING MACHINE.





All the three wells are very large in size one being 150 feet long 75 feet broad and 10 feet deep and two others 75 feet square and 10 feet deep. All the wells are completely stone-rivetted.

The history of these wells is rather interesting. One of the first improvements carried out on the farm was the drainage of the wet area, the soil of which is a rich clay requiring considerable drainage. Mr. Krishnaiengar excavated deep open drains all around the property and also a main drain right along the centre. He did also a certain amount of under drainage, the drains being of the pebble drain type, *i.e.*, filled with coarse stones and gravel and covered over, and connecting up with the main ditch. The land naturally improved vastly but Mr. Krishnaiengar thought that a great deal of water was being lost through these drains. As the water supply in the tanks was rather precarious and as such a condition was fatal to sugar-cane cultivation he decided to catch and impound all the drainage and percolation water so as to make use of it for irrigation again. The wells above mentioned have been the result. These wells are situated along the main ditch at convenient intervals between the tank and the tail end of the Farm. What an important irrigation source these wells are may be judged by the fact that Mr. Krishniengar thinks they save nearly a third of the crop every year.

For lifting the water from these wells engine driven pumps are installed on two of them. Two four inch centrifugal pumps are worked, one by a 10½ H. P. Hornsby oil engine, and the other by 6½ H. P. engine of the same type. The engines and pumps cost at the time they were purchased, *i.e.*, before the war, Rs. 4850. The pumps are worked only intermittently depending upon the rainfall and the amount of water in the tanks. The engines and pumps are run and looked after by the village *Thoti* whom Mr. Krishnaiengar has trained for the work. In fact it is one of the admirable features of the Farm that all the work is being done by Mr. Krishnaiengar's local ryots themselves, the more intelligent of whom have been carefully trained by him for all this comparatively superior class of work which would usually require the somewhat costly services of more than one well-trained mechanic. Mr. Krishnaiengar estimates that the cost of lifting water in this way amounts to a rupee per hour of pumping. The irrigation water is further conserved by the use of water-tight conduits for carrying the water. Mr. Krishnaiengar har

used large stoneware pipes and mortar-lined channels for carrying the water, thereby preventing a great deal of wastage of water in transit. Some 2400 feet of 9″ stoneware pipes have thus been used at a cost of Rs. 4800.

Mr. Krishnaiengar has been one of the first to appreciate the value of the improved tillage implements. He has entirely discarded the country plough and uses only improved ploughs both on the wet lands and dry lands. He keeps 12 ploughs of the K. M. type for ordinary work and 3 heavy "Verity" ploughs for work on his sugar-cane fields. The recurring charges due to the wearing out of the shares and their consequent replacement is very heavy and would really have frightened off any one not possessing the absolute faith of Mr. Krishnaiengar in the fact that these ploughs are economical notwithstanding the cost. Were it not for these improved ploughs Mr. Krishnaiengar would have had to use at least twice as many pairs of bullocks as he now does. The large pile of worn out discarded shares is one of the sights of the Farm. Mr. Krishnaiengar states that each plough wears out 10 shares in the year. In addition to the improved ploughs 3 Planet Junior Cultivators, 4 lever harrows and 12 bullock hoes or *kuntes* of the country type are kept.

On his wet lands the main crop is sugarcane. The whole Farm may really be considered as a Sugarcane Farm and the cropping scheme is designed almost entirely in the interests of Sugarcane cultivation. The rotation on the wet land consists of Sugarcane followed by Ragi and to a small extent fodder Jola, both grown as dry crops. Mr. Krishnaiengar has entirely given up the traditional sugarcane-paddy rotation which is the one followed throughout the State. The Ragi-sugarcane rotation followed on his estate is advantageous because it avoids the harmful effects of puddling and also means a great saving of irrigation water. Sugar cane is grown in the most intensive manner; up to 3 tons of oil cake is used as manure per acre and a heavy crop amounting to as much as 500 maunds of Jaggery per acre is obtained. About 25 acres of canes are cultivated annually but in favourable seasons the area is increased up to as much as 40 arces.

For the milling of this cane and boiling it down into jaggery a power crushing mill is employed and a multiple-pan furnace is used. The power mill is one of the earliest improvements introduced by

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INTERCULTURING YOUNG SUGARCANE.—NOTE THAT WIDER SPACING PERMITS THE USE OF BULLOCK-DRAWN INTERCULTURING IMPLEMENTS, THUS EFFECTING ECONOMY IN THE COST OF WEEDING.

SUGARCANE TEN MONTHS OLD. COWPEA IN THE FOREGROUND TO BE USED AS GREEN FODDER.

Mr. Krishnaiengar and in this respect he may be considered to be one of the pioneers in South India. Without such an outfit it would have been impossible to grow sugarcane largely and it was only after experiencing great difficulty in trying to mill even a comparatively small area with ordinary bullock mills that Mr. Krishnaiengar gave them up in favour of a power mill. The power mill used is an 18″x12″ mill obtained from A. W. Smith & Co., of Glasgow at a cost of Rs. 1500. It speaks volumes of the excellence of this mill that it should be running in perfect order for the last 15 years. The mill is driven by a 10½ H.P. Hornsby oil engine which cost Rs. 2500.

Improvements in jaggery boiling methods have also been steadily effected one after the other. The juice is boiled only in open pans over an open fire much as it is done by the ordinary ryot, but instead of one pan each furnace carries two pans in series, thereby effecting a certain amount of economy in fuel. Four such heating units are used and from 35 to 40 charges are boiled per day of 18 hours, each charge giving about 3 maunds of jaggery.

The threshing of the ragi is all done by a threshing machine driven by one of the engines on the farm. Mr. Krishnaiengar gave a description of his threshing outfit in the pages of this Journal (Vol. I. No. 3) and stated that without this outfit it would be impossible for him to get through the threshing work in time as other important operations in connection with cane planting and milling also occur at the same time. The machine is of American make, being manufactured by Messrs. Heebner & Co., of Lonsdale Pa. U. S. A. and cost Rs. 650. This is driven by a 6½ H.P. Hornsby oil engine.

Live stock is a side line on which Mr. Krishnaiengar bestows much care and attention. Some very fine specimens of both draught bullocks and breeding bulls can be seen on the Farm and at the annual cattle fairs Mr. Krishnaiengar generally picks up the very best specimens, regardless of the cost. He maintains 8 pairs of working bullocks costing from Rs. 400 to Rs. 1250 per pair.

Of breeding bulls two excellent Hallikar bulls costing Rs. 400 each are kept. A herd of 60 cows and buffaloes is maintained.

The cattle are looked after with great care. Green fodder is fed liberally. Nearly the whole *avare* (lab-lab) crop grown as *akkadi* in the dry land ragi is used as green fodder. Likewise fodder jola

and even ragi is fed. In addition the usual concentrated feeds like oil cakes, gram, etc., are also given.

The cattle stall is a spacious structure and the stall accommodation is itself 600 feet by 14 feet. The stalls are arranged around a central square open court yard. Six farm carts and one for family use complete the equipment of the Farm.

The comforts of the farm home have not been neglected. A spacious well-built brick and mortar dwelling house has been constructed on high ground commanding a full view of the Farm.

The arrangement for the supply of drinking water for the Farm is interesting and has always struck us as a curious index of the way in which Mr. Krishnaiengar views farm work. For a long time water for domestic purposes used to be carted up in barrels from the tank to the Farm house. At present a small well costing Rs. 50 has been sunk in the tank bed and a three-rammed cattle power pump, admirably simple and efficient, has been installed. The lift from the well to the bungalow is about 80 feet and the cost of the pump and the necessary pipe line for the well up to the house cost Rs. 2000. The work is exceedingly easy for one pair of bullocks and the pump delivers 320 gallons per hour.

In the matter of labour for his farm Mr. Krishnaiengar has been fortunate. The village supplies all the labour necessary both permanent and casual. Thirty permanent labourers are employed on wages ranging from Rs. 8 to Rs. 12 per month. Casual labour is employed whenever wanted and is available at $4\frac{1}{2}$ and $2\frac{1}{2}$ annas per day for men and women respectively. The whole establishment is under a Manager who is paid Rs. 100 a month. It is hardly necessary to add that Mr. Krishnaiengar resides on his Farm and attends personally to the management.

Dry Cultivation near the Town of Mysore.

BY

K. Narasimaiyengar,

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IN regard to light soils, it is known that a ryot can cultivate five acres of dry land with one pair of bullocks if he used only the country plough. With the help of an improved plough and other simple labour saving implements of the country type, he can manage to cultivate from eight to ten acres. I wished to know how far the above statement holds good, in the case of this part of Mysore, where we see two well-marked seasons, *kar* and *hain*, in which valuable crops are usually grown. On the Agricultural farm here, a few simple but useful labour saving implements are in use. I therefore examined the work done on the farm in the years 1919 and 1920. I have given the result below. One pair of bullocks is at present kept on the farm, and the crops grown there are all rain-fed crops.

The labour-saving implements that are in use on the farm are the following : –1. Kolar Mission Plough, 2. Kolar Mission Cultivator, 3. Chitaldrug Big *Kunte*.

To expedite ploughing, two country ploughs are tied to the yoke and two men plough the lands once or twice, according to circumstances, finishing $1\frac{1}{4}$ acre or a little more per day of about 7 hours. This operation decreases the rapidity of the evaporation of soil-moisture. The lands are ploughed subsequently with the Kolar Mission Plough. To expedite sowing, the Kolar Mission Cultivator is used. Excepting jola, cotton, castor and groundnuts, all the other crops grown on the farm are broad-casted, and broad-casted seeds are always covered with the Kolar Mission Cultivator, getting through about 3 acres per day. Chitaldrug *Kunte* is used whenever necessary in the preparation of soils and in the destruction of weeds on ploughed lands.

The success of the whole work in a year depends on two factors:— 1. The extent of *kar* ploughed lands available at the beginning of the season. 2. Getting rains early at the beginning of the *kar* season. If enough of such land is made available, jola, the chief food-crop of the locality, is sown first, and usually sufficient

Statement in detail.

Nos.	1919.				1920.			
	Kar crops		Hain crops		Kar crops		Hain crops	
	crops	area in acres	crops	acres	crops	acres	crops	acres
1	Jola	5·04	1. Madaiyana Giri Ragi.	1·17	1. Jola	3·88	1. Madaiyana Giri Ragi,	0·65
2	Kar-Ragi	1·38	2. Green-gram.	1·23	2. Kar Ragi ..	1·94	2. Green-gram.	1·80
3	Gingelly	0.85	3. Alsundi.	0·50	3. Gingelly ..	1·25	3. Alsundi.	3·10
4	Castor	1·86	4. Horse gram.	2·90	4. Castor ..	1·23	4. Horse gram.	4·61
5	Cotton	0·46	5. Niger.	0·73	5. Cotton ..	0·50	5. Fodder Sorghum.	0·40
6	Fodder Sorghum (Jola)..	0·18		..	6. Fodder Sorghum.	1·18		
7	Ground nuts	0·25			7. Chillies ..	0·50		
	Total ...	10·02		6·53		10·48		10·56
		16·55 acres				21·04 acres		

In the year 1919, 6·43 acres of land were *kar* ploughed, that is, were prepared at the end of the year for sowing *kar* crops early in the following season, and 6·23 acres were similarly prepared in the year 1920.

Abstract.

Area available for cultivation.	Area cultivated in the years		Area on which one crop was grown in		Area on which two crops were grown in	
acres	1919	1920	1919	1920	1919	1920
13·90	Acres 12·42	Acres 13·97	Acres 8·29	Acres 6·93	Acres 4·13	Acres 7 04

time will be found not only for the destruction of weeds on *kar* ploughed lands on which *kar* ragi and gingelly are sown, but also for the preparation of lands on which other crops are sown. *Kar* ploughed lands admit of sowing a second crop of Alsandi or green gram which ripen in 2½ months, and also of Horse gram. If the two former are sown, the land can be *kar*-ploughed at the end of the year. By adopting the above plan, the area cropped is increased as also the area *kar*-ploughed. The programme of work is sometimes upset by rains coming late in the season. In these years there will be a decrease in the extent of land cultivated.

The Cultivation of *Rasabale* Plantain in Nanjangud Taluk.

BY

Mr. M. S. Ramachandra Rao,

Agricultural Inspector, Nanjangud.

History.—The cultivation of this crop has been in existence for the past nearly a century and a half. It is held that the variety was first brought over to this locality by an enterprising ryot of the Taluk from one of the districts of the Madras Presidency. Success attending his trials, others took up its cultivation so that we find to-day an area of nearly 200 acres under it.

Its extension.—Its fruits are highly esteemed both for their harmlessness to the body and their sweetness. As such, there is always a ready market for this valuable product. The recent war has contributed much towards its success as the prices of fruits have more than doubled at present. As a result of all this, the cultivation of the crop is rapidly extending now all around.

Soil suited.—The soil required for the crop is a clayey red loam with a slight admixture of sand and facilities for good drainage. It can also be raised on black-cotton soil if irrigation can be satisfactorily done. The alluvial soil situated on both sides of the river Kapini, in the Taluk, is regarded best for it.

Season.—*Pushya Bahula* and *Ashada Shudda*, *i.e.*, the first half of January and the second half of June respectively are the months for its planting. Of the plantings, the former is the better as a chain of festivals succeeds the harvest resulting in high prices for the fruits.

Preparatory tillage.—Two ploughings generally with the improved plough are given to a depth of half a foot. The field is left to the action of the sun and atmosphere for a month. A hand digging is then given to a depth of a foot and a quarter. The clods are all crushed. Weeds are collected and burnt and the field is ready for laying out beds.

Laying out beds.—About a fortnight before the actual planting, the field is laid out into beds 9 feet long and 8 feet broad with pits made in each of them for receiving a plant.

Planting.—Good selected suckers are purchased and planted in the pits at the rate of nearly 600 to an acre.

Manuring.—A small dose of wood ash is now applied to the plants and the pits are covered over with mud. The total quantity of the ash used for a crop is 30 cart-loads to an acre. Oil cakes are also applied but only in the fourth month of the crop at the rate of ½ a ton per acre.

After-cultivation.—Weeding is given five times in a year at the first, third, fifth, eight and eleventh months of the crop. It is regularly irrigated once in a fortnight during summer.

Harvest.—The crop begins to mature by the fourteenth month and continues to yield till its twentieth, the 17th and the 18th months of the crop being the period of highest yield. The harvesting operation goes on throughout this period.

Rotation.—It is chiefly rotated with paddy. A field carries a plantain crop generally for three years; after this paddy succeeds for two years. The latter crop will have to be heavily manured as the soil will have become exhausted by plaintain.

The working expenses of an acre of " ***Rasabale*** **" is as follows :—**

FIRST YEAR.

	Rs.	A.	P.
I. Two ploughings with the improved plough at Re. 1—8—0 for each ploughing ..	3	0	0
II. Two Hand diggings at 10 coolies for four days for each digging (cooly wages 8 as. a day) ..	40	0	0
III. One cultivating at Re. 1—4—0 each ..	1	4	0
IV. Collecting weeds and burning them. Eight female coolies for four days at Rs. 0—4—0 each cooly per day	8	0	0

	Rs.	A.	P.
V. Making beds 20 coolies for 2 days—cooly 8 as. a day	20	0	0
VI. Making pits for planting at 30 pits for a cooly (605 pits)	10	1	4
VII. Cost of seeds 605 suckers to the acre Rs. 5 for every 100	30	4	0
VIII. Planting charges. one cooly for every 100 suckers (605 suckers to the acre) ..	3	6	5
IX. Manure. 30 cart loads of ash at Rs. 0–12–0 each cart load and half a ton of groundnut cake at Rs. 70 a ton	57	8	0
X. Application of manure at 15 coolies for an acre for two days	15	0	0
XI. Weeding. Five times at 12 coolies for two days at every weeding	60	0	0
XII. Care taker's charges for six months of harvest at Rs. 5 per month	30	0	0
XIII. Land tax	5	0	0
Total Rs. ..	283	7	9

YIELD :—

605 bunches containing 50 fruits (on the average) each at Rs. 20 per thousand	605	0	0
Deduct charges of cultivation	283	7	9
Net Profit ..	321	8	3

SECOND YEAR.

Charges of Cultivation	120	0	0
Value of yield obtained	605	0	0
Net Profit ..	485	0	0

THIRD YEAR.

(*a*) Charges of cultivation	20	0	0
(*b*) Yield of leaves at two *kavaliges* for every pit, *i.e.*, 1210 *kavaliges* at as. 2 each	151	4	0
Net income ..	131	4	0

	Rs.	A.	P.
Total charges of cultivation for three years put together	423	7	9
Total value of yield for all the three years is ..	1361	4	0
Net profit for all the three years ..	937	12	3
Hence the average net income for a year from *Rasabale* is	312	9	5

Notes on the more Important Insect Pests of crops in the Mysore State.

BY

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Introduction.—I believe that the insect fauna of the Mysore State—surrounded, as it is, mostly by portions of the Madras Presidency—is more or less the same as that of the other parts of Southern India. A good deal has been published on the pests of Southern India the most important of the publication being Mr. Fletcher's "Some South Indian Insects" brought out in 1914. In Mysore itself short descriptions and notes on some of the important crop pests have been published in the Departmental Bulletins, Circulars and Calendars and it may be that these notes contain a good deal of information already known. My idea in preparing this paper is to bring together in a connected form all the scattered literature on Mysore insects, about which nothing has been published so far. It is hoped that the paper might form a useful list to begin with, both for the working Entomologist and the cultivator, in spite of the inevitable imperfections.

The pests are arranged according to the natural orders :—

(1) Coleoptera
(2) Lepidoptera
(3) Diptera
(4) Rhynchota
(5) Orthoptera
(6) Neuroptera
(7) Thysanoptera.

In conclusion I must reiterate that the list is not at all complete but serves as a small beginning.

1. Coleoptera.

Beetle pests.—Beetles are more destructive than is generally believed. As the majority of these insects live concealed and as their larvæ also live in hiding and do destruction in darkness, very little is known of their life history and habits. Some live openly on the plants, both the adults and larvæ destroying plants. Many live concealed on the tissues of plants and do destruction by tunneling stems and branches, others, live in hiding in the soil in all the stages and destroy crops, by cutting up the roots, the adult ones coming out at nights destroy the foliage of plants. Several others lay eggs on the stored grains, provisions, drugs, biscuits, etc., and do a great deal of destruction.

The most important beetles that occur as pests of crops in the Mysore State are :—

I. Epilachna Beetles.

(*Some South Indian Insects pp.* 292 *p* 1. 6.)

There are two species of these beetles that are serious pests of potatoes and vegetable crops. The beetles have a very wide distribution in the State, but generally are found as a serious pest on potatoes in the Bangalore and Kolar districts which are large potato growing areas.

Clusters of yellow eggs are laid on the food plants and from these yellowish spiny grubs hatch out and immediately begin feeding on the foliage of the plants. Both the adult beetles and the grubs are destructive to the crop.

The beetles have other host plants when the above cultivated crops are not found, these being Datura Stramonium, Solanum Nigrum and Withania Somnifera. These weeds are found growing around potato areas. Thus, the beetles are found breeding throughout the year.

Control.—There is a small (Chalcid) wasp parasite which is a natural check on the grubs to a certain extent.

Hand-picking and destruction of the beetles in the very early stages of attack have been found to be the best remedy.

Stray potato plants and other host plants of the beetles that breed the pest out of the crop season should be pulled out and destroyed.

II. Cantharid Beetles.

(*S. S. I. I. pp.* 303.)

The commonest species that is met with in very large numbers is Zonabris pustulata. This is the common black beetle with rebands on the front wings. The beetles are found in almost all places in the State. These occur in large numbers in September and consume the flowers of Rosa sinensis, Hibiscus esculentus and flowers of almost all Cucurbitaceous plants. Togare (red-gram) flowers were found damaged in October and Apple blossoms in May in Bangalore.

Another species, dark blue in colour with a red head (Epicauta herticornis) was found to attack vegetable flowers in September and then the paddy crop close by was attacked, in the Kadur district.

Control.—Collection of the beetles in small hand-nets.

III. Rhinoceros Beetle.

(Oryctes rhinoceros, Linn.)

(*Ent. Memoirs Pusa II P.* 163.)

(*S. S. I. I. pp.* 285.)

This is a serious pest of cocoanut and date palms and has a very wide distribution in the State. It is a black strong-built powerful beetle with a stout blunt horn on its head. It is on account of this horn that the insect is called Rhinoceros beetle. The beetle remains hiding during day time and flies about at nights. The beetle does damage by boring into the crown of the palms and when the top shoot is destroyed the plant dies. Both young and old palms are attacked. The beetles are found to attack the growing shoots of American aloes, the attacked plants being easily made out by the clean, oval, fairly big holes very prominently showing out of the leaves of the plant.

The whitish round eggs are laid in manure pits, on semi-dry manure, and also on the decaying stumps of cocoanuts and dates. Very large numbers are found breeding in the manure pits in the villages close to the cocoanut gardens. The larvæ are well-known creatures which go by the name of "Gonne Hula" in Kanarese. These pupate in the soil below the manure pits to a depth of 6″ to 9″ Pupation also takes place in the soil on the sides of the manure pits.

There seems to be no particular breeding season as the insects are found in all stages of development in the manure pits, etc., throughout the year, but July and August seem to be the months in which large numbers of beetles are found damaging the palm trees.

CONTROL.

(i) A stout wire bent like a hook is inserted in the hole made on the crown of the palms by the beetles and they are destroyed, as these beetles are invariably found in these holes during day time.

(ii) Traps of decaying vegetable matter, manure, decaying cocoanut stumps, etc., are established in the gardens. These are raked up several times during the year and all insects found are destroyed. The soil to a depth of 6″ to 9″ beneath and around these traps should also be dug out and the pupæ killed.

IV. The Palm Weevil.

(Rhynchophorus ferrugineus, Fb.)

(*S. S. I. I. P.* 343 *Pl.* 14.)

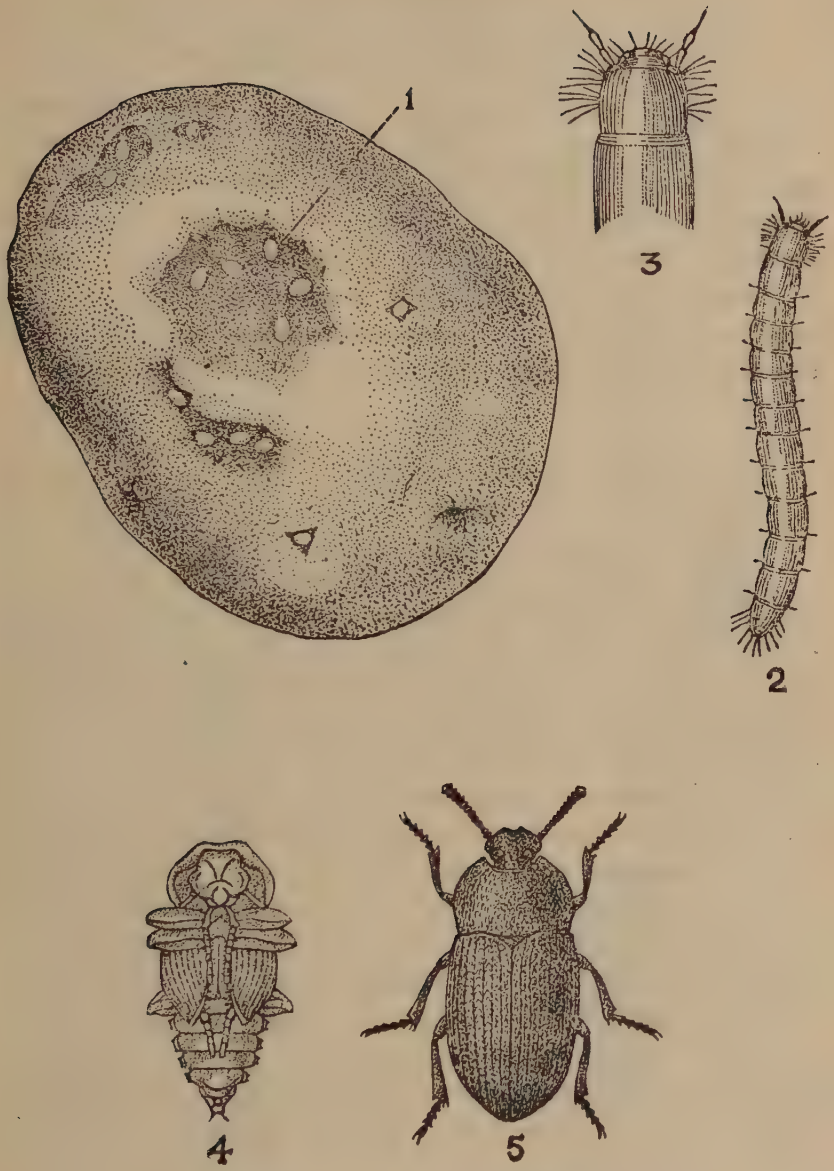
This is a fairly large red beetle with a long pointed snout in front. This insect is found wherever cocoanut and date palms are grown in the State. Eggs are laid in the tissues injured by the Rhinoceros beetle in the crown of the palms, the grubs hatching out work into the fibrous portions of the crown ; thus the work of destruction started by the rhinoceros beetle is completed by this insect. Eggs are also laid in large numbers on the exposed and fermenting central fibrous portions of freshly cut date or cocoanut stumps. The grubs on hatching out work their way downwards to a depth of a foot to 15 inches and then turn towards the sides and pupate. The pupal case consists of the palm fibres twisted round. Over 200 grubs in all stages of development were found in a freshly cut date stump 2 feet high. On approaching the stump a fairly loud and peculiar noise was heard at very short and regular intervals. This was produced by the large numbers of grubs cutting through the hard and fibrous tissues of the trunk and boring in. The weevils are attracted towards fresh drawn toddy, as many are found drowned in the toddy accumulated in pots tied to trees by toddy-drawers.

Control.—The control measures adopted for the rhinoceros beetle will control this also.

V. Sagara nigritia.

This is a fairly large bright green insect easily made out by the prominent swollen hind pair of legs. It is found in the winged stage from June to September in Bangalore. It is found breeding in large numbers on the main stems of the climbing bean (lab-lab) trained on overhead trellis work. The eggs are laid in the stems, the grubs hatching out work their way into the stem and as the former develop, a fairly big gall is formed. This shows as a small swelling $2\frac{1}{2}$ months after the eggs are laid. Pupation takes place inside the gall 7 months after the egg-laying and the adult beetle comes out of the gall, cutting round hole, from 4 to 5 months after pupation. Thus the life cycle occupies about a year.

Control.—Splitting open the galls by a sharp knife when they are just forming and destroying the grubs inside.



GONOCEPHALUM HOFMANNSEGGI

FIG. 1.—Potato Tuber showing excavations made by the beetle with eggs laid in them.

FIG. 2.—Full-grown larva of beetle.

FIG. 3.—Head of full-grown larva enlarged.

FIG. 4.—Pupa.

FIG. 5.—Adult beetle.

VI. Ground Beetles.

Gonocephalum hofmannseggi.

(*Mysore Entomological Bulletin No.* 5).

Several species are found, but the above species is the insect commonly met with. It is only an occasional serious pest of ragi, potato and vegetable crops. The grubs of this beetle remain underground and damage the tubers of potatoes and roots of ragi seedlings. The beetles too are found damaging the potato tubers.

Control.—The beetles hide under heaps of grass, rubbish, etc. Small heaps of these are put up in the fields and bunds, and the beetles that are found under these rubbish heaps are regularly destroyed.

VII. Coffee Borer.

Xylotrechus quadripes, Chevr.

(*Mysore Agricultural Cal.* 1918, *pp.* 17).

(*Mysore Entomological Circ. No.* 20).

(*Mysore* „ *Kanarese No.* 29).

This beetle is a very serious pest of coffee plants. It occurs in almost all coffee estates, particularly on those on lower altitudes. The beetles are in the winged state from about October to the end of December. Eggs are laid beneath the loose scaly bark on the coffee stems. Eggs are also laid underneath moss and lichens found growing on coffee stems, the scrubbing of which has not been attended to. The grubs on hatching first bore into the bark, making tunnels round the stem but as they grow older the woody portions of the stem are tunnelled. By the time the grubs are full grown tunnels are made throughout the stem, thus weakening the plant considerably. Old plants are able to withstand the attack for a few seasons but young plants die within a year or two of the attack.

Control.—Scrubbing the coffee stems by means of brushes made out of cocoanut husks, or gloves made of coir rope in the egg-laying season has been found to dislodge the borer eggs and kill them to a very great extent.

(2) Brunolineum—a coal tar product—after being converted into an emulsion with soap and water, was applied to the coffee stems at the end of the egg-laying season. The stuff has very great penetrating power so that the tunnels made on the bark by the young grubs are penetrated by it and they are killed.

(*To be continued.*)

FIG. 3.

Stem of coffee tree attacked by borer. At the top of the figure, the stem ha been split to show the burrow of the borer. Below are to be seen the exit holes of the beetle and the thickening and the cracked appearance in the bark due to the borer.

FIG. 1.

Larva of coffee borer beetle.

FIG. 2.

Pupa of coffee borer beetle.

FIG. 4.

Adult female coffee borer beetle.

FIG. 5.

Adult female of borer in Kalasadle (Olea dioica).

FIG. 6.

Egg of coffee borer beetle in the bark of a coffee stem.

The Areca Drier.

Mr. Kuntgodu Sivaramayya, Sagar Taluk, writes :—

I HAVE dried arecanuts this year, with the help of the areca drier constructed for me by your Department during October 1920. The arecanuts dried in the drier have got much the same colour as those dried in the sun, much to the satisfaction of my neighbours who saw the stuff. I am glad to find that there is no difference in colour between the nuts dried in the drier and those dried in the sun. It is well known that, in the malnads, owing to the rains during October, there is considerable delay in harvesting the nuts, with the result that some of the nuts become overripe (called "Gotu"). While the "chibbalu" or the right quality of nuts will sell at Rs. 11 a maund, the Gotu fetches only Rs. 4 a maund in the market. Thus the garden owner loses Rs. 7 a maund. With all this, some of the garden owners adhere to their proverbial system of drying the nuts over a fire, during the rainy season. The stuff thus dried often gets charred and smoky and loses its proper weight, fetching only Rs. 6 or 7 per maund. These facts are well known to all and in my opinion it is very convenient if the garden owners would construct driers for their use. I have given the following data for your kind perusal.

Weight of nuts shelled and boiled.	Weight of nuts after drying.	Time taken.
129 lbs.	47 lbs. in the drier	24 hours.
129 lbs.	47 lbs. in the sun	4 days in the sun.

NOTES AND COMMENTS.

By the Editor.

Silage at the Hebbal Dairy.

In reply to an enquiry, the Live Stock Expert has sent us an interesting communication on the results of the Silage experiments, which were notified in the last number of the Journal. We publish this letter in our "Query" column.

* * * * *

The Vth Quinquennial Cattle Census of Mysore.

We publish among our "selections" the results of the Cattle Census held recently in the State. There has been a steady rise in the number of bulls and bullocks during the past 25 years as may be seen from the following :—

Year.	Number of bulls and bullocks.
1900	1,489,814
1905	1,468,083
1910	1,631,871
1915	1,683,239
1921	1,697,002

In the light of these figures there does not seem to be any ground for alarm that the country is being depleted of its cattle.

The census also brings out that the number of improved ploughs used in the State has risen by 3522 during the last quinquennium, the total number now in use being 6762.

* * * * *

Fighting the Sugarcane Borer with parasites from Cuba.

The Lausiana Planter gives an account of the several sugar companies, and estate owners in that State who are raising a fund for the purpose of employing an agency to proceed to Cuba, to collect and forward the parasites that destroy cane borers. A batch of students of the local University under the leadership of an Entomologist was sent out to Cuba for the work. Large numbers of the parasites were collected and despatched to the State Entomologist,

who in turn sent them to the contributing Estates and Companies in the order of the amounts contributed. The cost of this campaign is said to be about $ 10,000.

It would be interesting to know the results, which we shall not delay to publish in our Journal as soon as we are in receipt of them.

* * * * *

The Mango Hopper and Mildew.

These two mango pests are reducing the mango in Bangalore to a delusion and a snare. For the past two years in succession the mango trees in the orchards and gardens of Bangalore have been one mass of blossom in the early spring gladdening one with the promise of a bumper crop ; within a month, however. the blights had done their work and very little fruit set : shiny slime on the leaves and dripping down, dark withered flowers strewing the ground under the trees, and millions of hoppers rustling and peppering one all over as the trees are approached is all that is left. The complaint is being heard from many quarters, and we are informed that gardens that used to be a source of considerable profit do not yield enough to pay the assessment on the land. The Department of Agriculture has been demonstrating the value of spraying the trees against both these pests ; but the campaign needs to be greatly extended, the necessary appliances being suitably adapted for large scale work. A correspondent writing in the local newspapers on this matter believes such methods will not be suitable for large orchards. We, however, think otherwise ; and as no other alternative course is open, this one will have to be given an extensive trial. We commend this to the notice of the Director of Agriculture and the Superintendent of Government Gardens.

* * * * *

New Crops in California.

California is associated popularly with oil and fruits ; but she is rapidly adding more strings to her bow. We read that rice growing has extended greatly and that it has now risen to a position of equal importance with wheat growing in that State. The value of the industry at present is in excess of 5 crores of rupees, which is considerably more than the value of the rice produced in our own State. Another crop which has also passed the experimental stage

is chillies. We are told that one country raised chillies of different varieties on 5,600 acres. The total output is estimated at 2,500 tons of dried chillies and 2,500 tons of a long variety used green and the monetary returns from the crop to exceed those from oranges, beans, peaches, apricots and eggs. It is also stated that the industry is growing by leaps and bounds. Our authority is troubled as to who eats all this hot stuff.

California's production of long staple cotton is likewise increasing, as we noted in one of our former issues.

We read that prompted by the high prices and the new uses of castor oil, the castor bean was experimented with but was given up on account of the high expense of cultivation, chiefly the harvesting costs. The present monopoly in many kinds of products held by India and countries similarly situated may not last very long at the rate at which progress is being achieved here and elsewhere in the world.

* * * * *

The Care of Mango Orchards.

Does it pay to bestow much attention on mango orchards ? On the estate of one of our members—Mr. MacIsaac, two years' experience goes to show that attention to tillage and clean culture has much to do with the crop. Mr. MacIsaac took up a derelict orchard which had been so badly neglected that the trees were choked with lantana. He cleared these bushes and ploughed the whole orchard with his deep plough using the Fordson Tractor for the work ; every bit of ground in the orchard was covered in this way, the plough being taken very close indeed to the trees. The change wrought has been truly marvellous ; the orchard which had not borne any crop worth mentioning for many years burst into blossom profusely this year and thanks to the absence of the mango hopper and the equally destructive mildew in the neighbourhood a goodly proportion set fruit also.

As we pointed out in one of our notes, for many reasons the planting of orchards, fuel and other plantations is increasing in the State ; but in many places the mango orchards receive little or no attention. Some ryots do a certain amount of rough ploughing during the commencement of the later monsoon, more probably for the sake of the horsegram crop they sow in such orchards than in the interests of the mango orchards. To those who believe that it is

only the season which matters and not the attention bestowed, so far as the production of a good crop is concerned, we would point to the example of the excellent mango orchards of the Srinivasapur Taluk. Here the gardens are well fenced ; they are ploughed more than once and kept quite clean ; low bunds are put up lengthwise and crosswise in the garden so that four trees are enclosed in each of these squares, the bunds helping to impound rain water and prevent wash during the rains. Down in the south of the Presidency we have seen such gardens given a good digging after the North-east monsoon ends, and during the hot months given one or two soaking irrigations as well. One does not chance to look into the balance sheets of such Estates—probably none are kept—but the ryot seldom goes to the expense of such operations unless he has reason to believe that they pay.

* * * * *

Cocoanut Varieties.

The following note about some of the freak or fancy varieties of cocoanuts in the East Indian Islands is interesting :—

" It is stated that among the varieties that are found to a limited extent is what is known as the ' Kapuno ', the meat of which fills the cavity of the shell. Then there is the ' tamisan ', the husk of which is sweet and edible. The ' nino ' is a dwarf cocoanut tree which, it is stated, is well adapted for ornamental use in gardens and along roads. The ' bankalen ' has a very thick husk, and would probably yield a large percentage of good coir. The ' manipod ' is a very precious variety, but with somewhat undersized nuts. Some varieties like the ' nino ' come into bearing when from three to four years old, but the varieties usually planted, and most esteemed for the production of copra, do not ordinarily arrive at bearing age until five or six years old."

We do not know if there are many named varieties of cocoanuts in Mysore. There is no doubt that though they do not bear distinctive names nor planted separately, each variety distinct by itself, still they are sufficiently large. Their characteristics of economic value are also sufficiently important to warrant study. At the first cocoanut show which was held under the auspices of the Department on an elaborate scale at Tiptur by the Taluk Committee of that Taluk some years ago, this matter was strikingly demonstrated.

Varieties showed differences in size, shape, and colour ; in number of nuts per bunch ; in the thickness of the husk as compared with the nut ; in the size of the nut ; in the thickness of the meat or kernel ; in the thickness of the shell ; in the taste of the kernel. These were striking to the ordinary observer while doubtless differences in the composition and other characteristics there were which could be detected by closer study. Of freak or fancy varieties there were not a few, nor any less interesting than the list quoted above. For instance there were those called "butter" cocoanuts in which the kernel when ripe is soft and can be squeezed between the finger and thumb. There were those called " Gangapani " nuts which gave very sweet milk and which though unripe could be kept for many days without going bad ; there were some nuts which give three shoots or " seedlings " from each nut all the three ovaries being fertile ; there were blind nuts, *i.e.*, those though fully developed were all husk or fibre and had no " nuts " in them at all ; there were also said to be trees in which the leaves in the frond were not separate but joined together. This much as far as could be judged from the collection exhibited ; probably there may be more. The subject is well worth being taken up for study.

* * * * *

Sugar-cane cultivation in the Districts.

We have more than once referred in these notes to the subject of the wider planting of sugar-cane. The practice in most parts of the State in the case of the varieties other than Cheni canes is to plant in rows about one foot apart. As the result of the demonstration held in the Goribidnur Taluk, we are glad to note that ryots are now adopting the practice of planting in rows 3 feet apart. In the current year it has been reported that nearly 150 acres have thus been planted. We have to acknowledge our indebtedness to one of our members, Mr. Lakshman Reddy, Patel of Sabbanahally, on whose estate we started to demonstrate this method about 3 years ago. All the 25 acres of his own sugar-cane crop have been planted in this manner ; he is testing planting in 4 feet rows with Pattapatti cane on one acre.

Likewise we note the increasing popularity of the " Nahan " sugar-cane mill in this and the Doddaballapur Taluks—two important

sugar-cane-growing taluks. In a single village we came across four of the mills working this season; they were being carefully watched and criticised as to their merits and drawbacks. Ryots also pay a higher rent for these mills than for the local ones, which is an unmistakable indication of what they think about these. Some of the larger ryots have gone in for more than one mill each.

It may not be generally known that the ryot — at least the Mysore ryot — would rather purchase a good article though costly than purchase a cheaper substitute because it is cheap. For instance in the case of improved ploughs the demand is all for the K.M. plough though it costs Rs. 25 and often is not procurable at all; he would wait till a fresh stock arrives and pay the higher price rather than buy the cheaper local made ploughs of the improved pattern. The same is the case with shares, which is still more striking, for these shares are really a great expense; yet he would buy none other than the good American made steel share regardless of the cost. We notice the same trait in regard to his attitude towards these new mills. The price frightens him at first, but he comes along all right in the end. Perhaps he thinks of " the Rs. 8 a maund " of jaggery and the " 8 seers a rupee " ragi! We would nevertheless give much for local manufacture and cheaper production, could we only bring it about soon.

* * * * *

Peanut Butter in the United States of America.

The vegetable oils of different kinds produced in the country form the poor man's substitute for ghee or clarified butter in India. These oils are used for this purpose in their natural condition and under their own names. Thus gingelli oil, groundnut (called peanut in America) oil and cocoanut oil are all used in this way both as cooking oils and for ' table ' use; each has its own special flavour and is fancied for special uses; to mask or remove the special quality would do away with its special merit.

Not so in Europe and America now-a-days. Both rich and poor must have their butter or something which resembles butter. For the better class of people there is real fresh butter to be had; the foreign grown imported butter supplies the household of ordinary folks; while the needs of the poorer classes are supplied by artificial

butter or Oleomargarine called also margarine. Animal fats, vegetable oils, with or without some genuine butter, coloured and churned up with butter milk, salted and put up to resemble butter as closely as possible, this is the composition called margarine. Large quantities of high grade vegetable oils, such as cotton seed oil, groundnut oil, and cocoanut oil, are imported for this purpose, but they all undergo a preliminary treatment before they enter into the making of margarine. The treatment consists in solidifying them and in deodorising them, that is, depriving them of their peculiar characteristics. So thorough is this treatment that not a trace of the smell can be detected ; in fact, margarine resembles real butter so closely that an ordinary man cannot make it out as different, and the 'pure food law' insists that all margarine be labelled conspicously as such, so that the public may not be deceived.

Peanut butter is a product in which this canon of a bland taste is not adhered to and this "Butter" preserves the distinctive odour and flavour of peanut oil being practically nothing but peanut seeds cleaned of the skin, ground up into a fine paste and salted ; it has the buttery consistence but the flavour is different and so is the composition, for besides the oil it contains the proteids of the seeds as well. Whether it can be considered to be a serious competitor with margarine cannot be said but that its use is greatly extending is clear from the following extracts from the Agricultural News of the West Indies.

"The commercial production of peanut butter in the United States has in recent years developed to large proportions, one manufacturer alone produced about 6,000,000 lbs. in 1919. There are dozens of large factories and hundreds of smaller ones. Peanut butter is probably the most important peanut product now manufactured in the United States. The peanuts used in making this butter in 1919 probably amounted to 6 or 8 million bushels, being at least 5 times the quantity used for this purpose in 1917. Peanut butter is a wholesome and a highly nutritious food, having, it is stated, a much greater food value than beef steak."

SELECTIONS.

I

The Poisonous properties of Castor-oil Beans.

There recently appeared in the Daily Press notice of a severe mortality amongst horses, due to the ingestion of castor-oil beans with imported chaff. Though the courtesy of the owner and the veterinarian in charge, an opportunity was given to a veterinary officer of the Stock Branch to examine the feed. It was found that some sacks of chaff contained, amongst other refuse, large numbers of different varieties of castor-oil beans. In order to put farmers and horse-owners on their guard it may be useful to point out that these beans are roughly oval, one-third to three-quarters of an inch long, and about half as broad, flattened on one side and marked with peculiar mottlings of red, brown or black and grey. The poisonous effect of the beans, in addition to their purgative action, is due to the presence of a toxin ricin, which is found not only in the whole beans but in the residue after the oil is extracted ; consequently neither the beans nor the residue are safe to feed, though the latter may be treated so as to destroy the toxin. Chaff containing these beans should on no account be fed. If by chance horses get them and show poisonous symptoms a veterinarian be called in at once, as the cases are usually very serious. *The Agricultural Gazette of New South Wales, June* 1920.

II

The Record of *Calamity Snow Pontiac*—the world's champion heifer.

In reply to your letter I am sending a few notes on Calamity Snow Pontiac. She is world's champion heifer under 2 years old for milk and butter in 365 days, having made at one year eleven months and eight days, 18,903 lbs. milk and 858 lbs. butter. Beginning another record on October 1917, 1918, as a four-year-old, she made in 365 days 25, 338 lbs. milk and 1,060 lbs. butter. Freshening again on December 22, 1919, she began another yearly record and finished on Dec. 22, 1920, with 28,442 lbs. milk and 1,240 lbs. butter in 365 days. This makes her average, for two consecutive yearly records, 26,890 lbs. milk and 1,150 lbs. butter.

During this yearly record she also made an official seven day record of 728 lbs. milk and 29·46 lbs. butter and in 60 days gave 6,007 lbs. milk or an average of over 100 lbs. daily for 60 days.

Her dam is Calamity Snow Mechthidde, who has 678 lbs. milk and 30·20 lbs. butter in 7 days, 101 lbs. in one day ; in 30 days, 2,859 lbs. milk and 126·49 lbs. butter. Eight months after calving she made in 7 days, 490·5 lbs. milk and 23·84 lbs. butter ; in 30 days, 1,954 lbs. milk and 92·25 lbs. butter, and in 365 days, 25,424 lbs. milk and 1,133 lbs, butter. Calamity Snow Mechthilde is a full sister to Calamity Snow Mechthilde 2nd, whose record was 32·70 lbs. butter in 7 days, and who produced in 3 consecutive years 72,050 lbs. milk and 3,150 lbs. butter,

or an average of 24,016 lbs. milk and 1,050 lbs. butter, one of these records being a three-year-old record. A sister to Calamity Snow Pontiac was first in the three-year-old class and second in general standing at the Guelph Dairy Test in 1920 and is on yearly test and it looks as if she will make 1,000 lbs. butter this year.

Walburn Rivers in the Canadian Countryman, Vol. X, No. 9.

III

Relation between the Hour at which the Mulberry Leaves are picked and the Silk Yield of the Silk-worm.

Leaves collected at the end of the day always contain more sugar and more proteins, formed during the day, than those picked at day-break. Leaves picked at day-break contain little of these compounds because, during the night part of them undergo changes and leave the leaf for other organs of the plant.

The author studied the differences produced eventually in the development of silk-worms and the quantity and the quality of their silk, by feeding them on :—

(A) mulberry leaves picked at day-break ; (B) leaves picked at sunset. All the conditions of vegetation, soil, climate, age of the plant, etc., were equal. In the spring of 1918 two groups of silk-worms of the yellow Ascoli breed, each from 4 gm. of eggs, were fed (A) on leaves picked toward 6 p.m. and kept in the dark on damp mats or cloths ; (B) on leaves picked between 5 and 6 a.m. Hatching, the four moults, and mounting on broom, occurred on the same dates for both groups. In Group A the mortality was nil, in Group B there were only a few cases. The total weight of the cocoons was 24·266 lb. for Group A, and 23·102 lb. for group B. The weight of 500 cocoons was 2,653 lb. for Group A, and 2·512 Group B. The number of cocoons per lb. was 187 for Group A, and 198 for Group B.

Sericimetric tests made at the " Laboratorio di studi ed esperienze seta of Milon, on raw four-twist silk, gave the following results for the Cocoons of each group :—

		Group A	Group B
Average Strength	gm. ..	50·03	42·86
Fineness	deniers ..	14·26	12·97
Strength per denier	gm ..	3·50	3·30
Elasticity	mm. ..	245·60	260.73
Length of silk thread	metres ..	888	884
Weight of silk thread	gm...	0·297	0·290
Fineness of silk thread	deniers ..	3· 05	2· 92

In comparison with the silk-worms of Group B, those fed on leaves picked in the evening, therefore, produced 9·213 lb. of cocoons more per ounce of eggs, and a better quality silk, except with respect to elasticity. It is, therefore, more profitable to both the breeder and the manufacturer to pick the leaves in the evening than in the morning. *International Review of the Science and Practice of Agriculture.—R. Sacchi in Informazoni Serichi Year VI, No. 6.*

IV

Modern Methods of Crop Production.

"Pulling Together."

(Dr. E. J. Russell in the "Conquest" of April 1920.)

The farmer, the chemist, the engineer, and the plant breeder have all made contributions to the possibility of improved crop production. The war has given an enormous impetus to co-operation, and team work is now the order of the day. The method of effecting improvements in crop production in a given district is to make a careful study of local conditions and then—

1. Select varieties of crops most suitable to the climate and the soil (the plant breeder's task) ;

2. Draw up a scheme of manuring suitable for these varieties and soils and calculated to mitigate any adverse effects of climate (the chemist's business) ;

3. Choose implements adequate for the work to be done and appropriate to the labour and capital available (the engineer's problem) ;

4. Draw up a scheme of cropping that shall secure them maximum output per acre of the desired crop at minimum expenditure of labour and money (the agricultural expert's business).

These four working together can hope to accomplish great things.

V

The Jackal Plague in South Africa.

The jackal is to the grazier in many parts of South Africa what the dingo is to our sheepmen in Western New South Wales and Queensland and northern South Australia, and a few notes as to the systems adopted for the former's destruction in the Cape Province may prove of interest and value to the dog-worried land-holders in this country.

Under the Cape Provincial Ordinance, the province is divided into circles, each with its own organization of affiliated hunting clubs or poison clubs, as the case may be, and each circle sends delegates to an annual congress for the purpose of reporting progress and devising further ways and means for pursuing the campaign against the arch enemy of the sheep farmer.

The bonus system is in vogue, and how it works is indicated in a report of the last jackal congress held in the terms of the Cape Provincial Ordinance. As the rewards for vermin destroyed are paid out of Provincial funds, it is a compulsory condition of the Ordinance that all circles whose units have received payments for "proofs" should be represented at the annual congresses to give an account, and render a report. The administrator who opened the proceedings of the last meeting was, however, reluctantly compelled

to draw attention to the fact that a goodly number of these circles have been very remiss in their duties. The result of this neglect was to show a very marked discrepancy between the figures rendered of vermin destroyed and vermin for which rewards had been paid, the latter being very much in excess of the former.

On the whole, however, the year's campaign against the common enemy was a fairly successful one as regards the numbers destroyed. The best results should appear to have been secured by the hunting clubs, the wariness of the jackal rendering the operation of poisoning clubs very uncertain. In this connection an interesting statement has been elicited to the effect that it is next to impossible to destroy a female jackal by poison. This is said to be due to the fact that the mother jackal possesses the power of vomiting her food at will, and uses this faculty for the purposes of providing for her young. That is to say, when she makes a kill on her food-hunting expeditions she gorges all she possibly can, using this method of carrying the food supply to her family in place of dragging it or carrying it in her mouth.

On arriving at her lair she disgorges the half-digested contents of the stomach for the benefit of the little ones. Having this power it follows, so it is asserted, and a writer in "The Farmers' Weekly" brings chapter and verse to prove it, that the female, if her suspicions are overcome as far as to lead to the swallowing of poisoned bait, promptly discharges the whole lot at the first sign of disturbance within her anatomy. The authority quoted declares he has poisoned hundreds of male jackals, but never a female, not even when he forced poisoned food down the throat of a tame female jackal that he had in his possession.

However, whatever may be the respective merits of the two forms of jackal destruction the sheep farming community in the infested districts are arriving at the conclusion that they are face to face with a pretty hopeless problem. Local efforts may be successful, but there are adjoining areas which it is impossible to clear out, and these serve as breeding grounds for keeping up a never-ending supply of jackals. Exactly the same difficulty obtains with the dingo in this country. There is a constant supply coming down into western New South Wales through Queensland from the unmolested breeding grounds on the South Australian side of the Queensland border.

The whole of the sheep-farming community in the Cape is arriving at the conviction that the only remedy lies in jackal-proof fencing, and a strong agitation is now afoot for securing legislative amendment to the General Fencing Act so as to extend the compulsory and contributory principles of that Act to the erection of the much more expensive kind of fencing required for keeping out the jackal. The greatest obstacle is the expense, something considerably over a £ 100 a mile, and very few farmers are in a position to embark upon

the big commitments that this style of fencing involves, though they think it can be done if Government will come to their aid by importing and selling the materials at wholesale prices, and allowing the repayments to be spread over a long term of years. There is probably big business in store for any manufacturer or contractor who could undertake to put up the class of fence required at a price that will not break the farmer.—*The Pastoral Review, No.* 2, *Vol.* xxxi.

VI

Udders and what they tell.

The udder must be spacious and shapen as it were a distinct member of the body, not merely just a lowering of the skin. Most of the best buyers prefer to purchase cows that are either down-calvers or newly calved, for with such animals before them they can quickly come to an understanding as to what the probable output of milk will be. With cows at these stages of profit there is some thing of a definite prospect as to what they will do in the milking line.

Care must be exercised in the purchase of aged cows. Many a man has been deceived in the purchase of such. One is received that is apparently correct in every detail, including a grand udder but when secured and weighed in the balance is found wanting.

Some cows yield profitably up to a very great age, but for all that it is best to treat such as exceptions and not the rule and look to younger stuff for some reliable points and lasting qualities.

As age creeps on the stability of the milking powers is very liable to relax and the quantity and quality of the milk becomes erratic. Not only have buyers been deceived in the purchase of old cows, but also when buying younger cows. It is the dimensions of the udder that count in favour of the good milker, but it is frequently the distension of the udder that rules the price and makes a cow "what she ain't," to the regret of some one, not usually the seller.

A distended udder does not, however, act as a "feeler" effectually where the pockets of good buyers are concerned in all cases. In fact, sometimes this move puts the damper on the sale of the animal or animals under consideration. The medium milker may be made to appear as a deep milker, but the faking business does not pay as well as it did a few years ago. The practised eye of the best buyers is not so easily deceived now-a-days. The dimensions of the normal udder are what such buyers centre their judgment on; they will have nothing to do with the abnormally distended udder.

Two or three weeks after calving is perhaps the best time to form a definite opinion, as to what a cow is likely to continue to do as a milker, the udder having at this stage resolved itself into its

normal state after the tension of calving. So far as teats are concerned size does not count for much. A teat that can be easily grasped would certainly seem to be most desirable, but small teats are generally readily responsive to the touch of the deepest milkers.

There must be depth of udder for milk, and, however handsomely shaped they may be, unless there is very considerable depth in the two front-quarters the udder is neither a heavy nor a long milker, *i.e.*, the period of lactation will be short. Much has been said in favour of teats set well apart. This is considerable qualifying point. If teats well apart before milking fall to and touch each other after milking, then they are a commendable point, but if after milking the teats are nearly as far apart as before the milking then there is nothing in them that bespeaks heavy milking.—*Live Stock Journal, London, December* 24, 1920.

VII.

The Preparation of Papain.

In the island of Montserrat a preparation of papain is made from the papaw. It is exported and used in the manufacture of peptonized foods and for medicinal purposes as it greatly promotes digestion. The Hon. Francis Watt, the Imperial Commissioner of Agriculture, at whose suggestion the industry was started in Montserrat, recently gave a very interesting account of the method of collecting and preparing papain.

"The milk of the papaw possesses the property of rendering meat tender, and in fact partially digesting it. The milk is obtained by making a scratch or shallow incision in the skin of the papaw fruit while in green condition. It is desirable to employ a bone or wooden knife in making the incision, as it is essential that no iron or iron utensils shall be employed. The milky fluid rapidly exudes and may be caught in a cup held beneath the fruit. A tin cup must not be used. Earthenware or glass vessels must be used for the purpose. The fruit is not removed from the tree and it may be subjected to the operation of tapping several times at intervals of two or three days. After collecting the juice soon coagulates and takes the form of a snow-white curd possessing a somewhat pungent but not putrid smell. It speedily decomposes if not rapidly dried, and when decomposing emits a most unpleasant odour. Drying is well effected by spreading the coagulated milk on drying frames made by stretching brown linen on light wooden frames, somewhat like those used for framing school slates. Drying must be continued until the substance is crisp and in such condition that it can be reduced to a fine powder without any difficulty being experienced from stickiness. The dried material should be ground to a fine powder, when the resulting product should be a white or cream coloured powder with a

characteristic but not putrid smell. Grinding is easily effected in a mill of the type commonly employed for grinding coffee. When grinding it is desirable to have the papain slightly warmed. The powder should be packed in tins or bottles and carefully preserved from contact with the air."

The eating of the fresh fruit promotes digestion, and as it is very palatable when ripe it is popular in the West Indies.—*The Tropical Agriculturist, Vol. LVI, No.* 3.

VIII

The Newer Knowledge of Plant Nutrition.

An article in the July number of the *Biochemical Journal* is worthy of the serious attention of all who are concerned with agriculture. The generally accepted idea of the nutrition of an ordinary green plant is that it requires only a supply of inorganic food material, consisting of minerals, carbon dioxide and water, from which it is able to elaborate the whole of its organic substance. This conception of plant nutrition, which forms one of the main physiological distinctions between plants and animals, has been modified during recent years by the work of Bottomley. Experimenting on the growth of green plants of *Lemna minor* in water culture, he has found that the addition to the inorganic nutrients of minimum quantities of certain organic substances is absolutely essential, if the plants are to grow healthily and normally for any length of time. These organic substances, which have been termed 'auximones' by Bottomley, are apparently similar in function though not necessarily so in nature to the 'vitamines', the accessory growth substances which play such an important part in animal nutrition.

The use of water-cultures affords practically the only means of absolutely controlling the food materials supplied to such growth since they normally grow with their roots submerged. This afforded the reason for the choice of *Lemna minor* for the experiment; the results of the experiment, however, led to the suggestion that perhaps this plant was peculiar in requiring some organic addition to its nutrient solution. A number of other water plants have been tested in the same way, and have all been found to grow healthily in the presence of a small quantity of organic material, while in inorganic materials alone they gradually died off, and this was the case, no matter what the nutrient solution employed. The well-known fact that ordinary plants will grow well in water culture is explained by the comparatively large quantity of organic food introduced in their seeds, and it was shown that wheat seedlings, with their endosperm removed at a very early stage, responded very much more quickly to the addition of these organic materials than plants which were not so treated. A number of experiments carried out with

cuttings demonstrated the absolute necessity of organic materials for normal healthy growth, and explained the prevalent idea of the unsuitability of cuttings for water culture. All these experiments tend to the conclusion that all green plants require the presence of organic material of a special kind for their maximum growth and development.

An entirely different type of plant, a yeast, has recently been the subject of similar researches on the part of Williams, who arrived at the conclusion that "a substance of unknown nature is necessary in addition to the ordinary nutrients for the nutrition of yeast cells," and the effect of the substance is so marked that he suggests that yeast may be used as a biological test for vitamines. He also concludes that this substance is identical with the animal beri-beri vitamine.

That all of the animal vitamines are direct products of plant synthesis appears to be probable. It has been ascertained by numerous workers that animals obtain their necessary vitamines from their plant food. It is now established that plants, in their turn, requires growth-promoting substances, or aximones; which in the case of some of the lower plants, are apparently manufactured by themselves, but which in the case of green plants, must be supplied from without. Since these accessory substances are essentially organic in nature, their only possible source in the case of ordinary green plants is to be found in the organic matter in the soil in which they are growing.

Bottomley has found that the products of the nitrogen-fixing bacteria can function as growth-promoting substances for the higher plants. It appears that the production of growth-promoting substances, whether plant or animal, is ultimately due to soil organisms, and that the moulds and bacteria of the soil organisms, and that the moulds and bacteria of the soil, growing upon the organic matter, produce these necessary substances, which are then absorbed by the plants and utilized in their metabolism, and eventually passed, either in the same form in which they have originally been absorbed, or as some other product of plant synthesis, to the animal in its plant food.

It seems probable, therefore, that the greater the bacterial activity in the soil, the greater will be the supply of plant auximones; and the bacterial activity may be concluded to be dependent upon the amount of organic matter present.

It is therefore of interest to find that the ordinary organic manures, which are generally applied to soils in agricultural operations, contain, in varying proportions, substances which are effective as plant growth-promoting substances, or auximones. Such ingredients are also to be found in well-manured fertile soil. A comparison between fresh and well-rotted stable manure shows that the rotted mannure is more effective than the fresh material.

The exact nature of these growth-promoting substances is still very problematical, but it has been found that peat contains derivatives of nucleic acid, and that these derivatives are effective in increasing the growth of plants. Microscopic examination has shown that the various auximones have marked influence on the size and the contents of the cell, especially on nucleus, and it seems not improbable that they might supply some essential nuclear constituent.

It is interesting to note that Schreiner and Skinner of the U.S.A. Bureau of Soils have found that nucleic acid and guanine and xanthine are beneficial to the growth of plants, the guanine especially to root development.

The value of organic manures is a well-recognized fact, and stress had been laid on their physical effect on the soil, and on the value of organic matter as food for soil bacteria ; but the fact that organic materials may be of direct importance to the plant has not yet received the attention that it merits. A number of physiological diseases in the last few years have been found to be associated with a deficiency of humus in the soil. The mottle leaf of citrus trees in California is a case in point. It seems not impossible that the cause of the die-back of the lime trees will be found to be due to a deficiency of some organic substance which, by limiting root development, prevents the necessary supply of water for the transpiring leaves. It may be that many of these malnutrition diseases of plants will ultimately be found to be, like the food-deficiency diseases of animals due to deficiency of some specific growth-accessory substance.— *The Agricultural News, Vol. XIX, No.* 480.

IX

Tests of Ploughs in India.

A greater interest is now being taken in agricultural implements by the natives and small farmers of India than has hitherto been the case. It is declared that there is an increased field for experiment and also greater scope for trade. Light upon the subject of ploughs, for example is given in a report we have just received of the annual meeting of the Mysore Agricultural and Experimental Union. The members have been testing different types of ploughs for use by the ryots, the principal implement being a new Hebbal plough supplied by the Agricultural Department. This type of plough was made by an ordinary native smith from metal obtained from a local bazaar, and its total cost was given as about Rs. 18, nominally 36*s*. The plough cut a 5 to 6 in. furrow, but many defects developed, these being attributed to the fact that the implement was made under difficult conditions and also to the poorness of the metal. One member found that after ploughing $7\frac{1}{2}$ acres of land the bar of the plough had worn away about 4 in. Other criticisms were on the

score of heavy draught, through not scouring properly, the inability to turn a clean furrow at all times, that the plough would not work on gravelly soil, and that it "skipped' on wet land. Trials have also been made with the Kolar Mission, a new bar-share, Syracuse Kirloskar and Verity ploughs, but no definite and conclusive data have been secured. The matter has points of vital interest for British manufacturers, for further experiments are to be made, and steps will be put forward to get better material. The need for British manufacturers to watch developments is made clear by the statement that it has been suggested that the Union should get soft centered steel from America. It is evident that propaganda upon our own behalf will be valuable, especially as India is likely to become a growing market for all classes of agricultural implement and machinery, and goodwill secured and extended now will later have enhanced value. The situation is put very cogently by Dr. Coleman, M.A., PH. D., Director of Agriculture in Mysore. He says :—

" I remember when I first came to Mysore we used to discuss gravely as to whether the Mysore Agriculturist would ever buy a plough which cost as much as twenty rupees. Such a question seems quite ludicrous now. We are selling ploughs by the thousand, practically all of which cost more than Rs. 20, and these are going out not to the well-to-do landholder, but in very large number of cases to the small ryot. We shall have to tackle the problem of the larger labour-saving implements and machinery. This problem is important, not only because of the rise in value of agricultural produce but because of the rise in cost of agricultural labour."—*The Implement and Machinery Review, Vol.* 46, *No.* 552.

X

Employment of Agricultural Machinery in the Cultivation of Rice in California.

The following is a summary of a translation from the French of an article by Silverrio Appostol in the Bulletin Agricole De'L Institute Scientifique De Saigon" for January 1921.

The author, who is the chief of the Plant Industry Division of the Philippine Bureau of Agriculture has recently completed an extensive tour of most of the principal rice-growing countries of the world and has chosen this subject in view of the tendency in many such countries to adopt modern methods of cultivation.

He keeps in view throughout the special climate conditions of California, and confines himself to a simple exposition of the actual methods observed by him during his visit, leaving the reader to make his own deductions as to their practicability under other and different conditions.

The cultivation of rice in California is confined to the broad valley of the Sacramento which is exceptionally favourable to the employment of agricultural machinery. In practice this is often of considerable power and weight. Multiple ploughs often with 8 or 10 shares, are used for working the land. On one occasion a specially heavy single-shared plough, drawn by a pair of 75 h. p. tractors, was seen in action breaking up the bunds before the general working of the land.

Harrowing and the reconstruction of the bunds are also carried out by mechanical methods. Transplanting is not practised : in its place large seed drills are employed. Weeding is the only operation carried out by hand and for this the labourers—many of them Asiatics—receive a daily wage of from 3 to 4½ dollars.

Threshing is done in the field, when all the sheaves within a radius of about half a mile are carried in specially constructed waggons to the threshing machine. When all these have been threshed the machine is removed further on.

The grain is often transported in sacks direct from the field by means of motor lorries or in trains of trailers drawn by tractors. The Four Wheel Drive tractor is specially esteemed for this class of work.

The exceptionaly favourable topography permits the establishment of large square fields of 5 to 15 acres—often of 30 acres or more—thus making easy the employment of large machines.

Apart from this, the extremely low rainfall—21·3 inches per year—is very significant. The land is worked immediately after harvest in October when the monthly rainfall is only about 2 inches. The frosts and thaws of the winter months make subsequent harrowing easy. The final working of the land is completed in March and April and sowing before the middle of May. No rain falls in July or August. The fact that all the cultural operations can be carried out during months when the rainfall is slight, together with the admirable irrigation and drainage systems which allow the soil water to be controlled at will, account for the ease and efficiency of the employment of Agricultural Machinery. – *The Tropical Agriculturist, Vol. LVI, No. 2.*

XI

Some Causes of Co-operative Failures.

C. C. Crane,

Organizing Inspector of the Agricultural Bureau.

Like all things worth the doing, the maintenance of healthy co-operative association is beset by certain difficulties and problems. Associations enthusiastically launched have been known to founder,

and many others have shipped heavy seas before ultimately reaching smooth water. Enthusiasm is an excellent thing — so long as its decisions defer to certain elemental laws.

Lack of Efficient Management.

A successful manager requires to have had an expert business training in all the lines with which he is operating ; he must be as well or better trained than the men who are operating in competition or opposition, and he must have administrative ability, integrity, and tact. Too often a co-operative society appoints a local man (possibly one of its members) as manager because he is popular and possesses some general qualifications rather than because he has any particular and specialised ability which fits him for the post. Too often an expert manager is unwisely restricted by members of the board, who have general but not expert knowledge, and who forget that while it is their duty to adopt a policy, it is essentially the manager's business to administer it, and that to do this efficiently he must be allowed considerable latitude and independence of action. Finally, it must be remembered that, as the position of manager calls for a specialist's qualifications, it calls also for a specialist's remuneration.

Lack of Loyalty of Members.

The foundation stone of any co-operative society is the individual member, and in a co-operation of producers his loyalty is of special and paramount importance. Loyalty means personal interest, enthusiasm, confidence, and complete support.

To ensure loyalty the initial cost of becoming a member should not be too small for the sum invested to be looked upon as a stake in the society the loss of which would be of importance to the member. Each member should feel that he has something to lose, something to gain, and that his interest is not merely sentimental but principally monetary. Steps must be taken by the secretary or committee where necessary to keep members well informed, and to explain positions that, if left in doubt, would cause uneasiness, or possible defection. Producers' co-operations have frequently found it advisable to insist that members deal exclusively with the co-operative business, and to insure against defection by instituting a scale of fees that must be paid as liquidated damages in respect of all business passed through outside agents or transacted privately by members.

Opposition.

The question of opposition is closely allied to that of loyalty ; for, while loyalty is maintained opposition must be ineffective. Rival companies and private competitors are likely to put up opposition in proportion to the menace that the co-operative association seems to promise to their interests, and steps calculated to cripple it may be expected at the earliest opportunity. Prices will be cut and inducements offered to members that will possibly appear extremely attractive.

The individual must be made to realize that concessions and benefits made at such a time by competitors are temporary, and due to the existence of the co-operative association. The association should be in a position to work more economically than any other concern legitimately could, and the committee should take steps to convince members that their prices represent the minimum when selling and the maximum when buying, and that finer prices represent a loss or at least a serious risk. The committee should see that members are kept informed as to (1) the benefit they have received from the association ; (2) the prospects the association opens up for them ; and (3) the possible results of the association's failure.

Isolation.

Asthe individual is the unit of the association, so must the association be but a unit in a co-operative federation ; that is, the local association should retain its individuality, but should by affiliation with others secure for itself as a society what it has as a union secured for the individual. In short, while local individualism is a necessary feature of the co-operative movement, a co-operative union or federation and a co-operative wholesale are equally essential. No society should endeavour to exist as an isolated co-operative undertaking.

Operating on too small a Margin.

Generally speaking, a co-operative association should not set out with the immediate object of cutting prices ; it should pay current rates when buying, and charge current prices when selling, for such will give a sufficient margin to tide the concern over times of distress. If, at the conclusion of the financial period, it is found that customers have been paid too little for their produce, or have paid too much for the goods they have purchased, this must be refunded to them *pro rata* of the business each individual member has effected with the association.

Unsuitable Scale of Operations.

Organization should not be considered satisfactory till there is a sufficient volume of business in sight to reduce to a satisfactory minimum the over-head charges which are a necessary cost on buying and selling. The larger the bulked trading transactions effected through the society the greater will be the reduction in cost to the individual.

A society must learn to walk before it can run, and its magnitude must depend on its capitalisation ; under-capitalisation means buying on terms and increases cost in every direction.

Purchase on the Credit System.

The main aim in Co-operation is to effect economy. Credit dealing is expensive and uneconomical, and, however inconvenient it may be for members to pay cash, the importance of the cash

purchasing principle in co-operative work is sufficient to warrant that inconvenience being imposed upon members. Generally speaking, if a co-operative society gives credit to its members, it must ask for credit from its wholesale suppliers.—*The Agricultural Gazette of New South Wales, Vol. XXXII, No.* 3.

XII

Changes in Manure during Storage.

However farmyard manure has been made, it starts with a mixture of excrement, urine, and litter, which become more or less consolidated and mixed together by the trampling of the animals. Other changes, however, intervene very rapidly, and these, in the main, are brought about by bacteria which, for convenience, may be divided into two groups, one acting on the cellulose and other carbon compounds of the straw that make up the bulk of the manure, and the other supplying the main fertilizing properties of the dung.

Among the more important of the organisms dealing with nitrogenous material are those which attack the urea in the urine, and by adding to it the elements of water give rise to a readily dissociated free ammonia and carbonic acid, both gases, and therefore capable of escape into the atmosphere. This change into ammonium carbonate is an extremely rapid one ; in the liquid draining from a yard or manure tank, little or no urea can be detected, so complete has been the change to ammonia. As long as the liquid containing the ammonium carbonate is protected from evaporation, no loss of nitrogen will result, but the more surface it exposes to the air, and the higher the temperature, the greater will be the amount of ammonia passing off in a gaseous condition. Thus thin films of urine on the floors, walls or even on the surface of loose straw easily lose nitrogen by the fermentation of the urea and subsequent volatilization of the ammonia. The smell of a stable arises in this way and is clear evidence of the escape of ammonia. As will be shown later, this volatilization of ammonia causes most of the loss of nitrogen that takes place in making dung.

The ammonium carbonate is itself subject to change and even to loss by other actions than evaporation ; there are always present in the manure heap bacteria, which can oxidise ammonia into nitrogen gas and water ; in consequence, dung, which is allowed to lie about loosely, is poorer in nitrogen from this cause, as well as through volatilization of ammonia. This process, by which gaseous nitrogen is set free, is often called " denitrification," a term better restricted to the change whereby nitrates are reduced to nitrogen gas. The conditions favourable to this change have not been closely investigated. It is, however, certain that rapid oxidation, such as is brought about by a loose condition of the manure, or by turning it, will be

accompanied by some destruction of ammonia. It is also favoured by the presence of soluble carbohydrate, *i.e.*, easily oxidisable material, and it is materially reduced if not suspended, as soon as these substances have been used up.

Another group of bacteria which are extremely abundant in fresh faeces are the so-called putrefactive bacteria which break down the proteins into simpler compounds, such as amino-acids, annides, and finally ammonia. Without discussing them individually their function is to convert the insoluble nitrogenous bodies of the straw (those of the faeces are more difficult of attack because they have already resisted the actions of the digestion) into soluble bodies akin to ammonia, and therefore more nearly available to the plant. Thus with a certain amount of loss of free nitrogen, the trend of the bacterial actions taking place in the fresh farmyard manure is to break down the complex soluble compounds of nitrogen to more and more simple ones, ammonia being the final form. At the same time there is always a reverse change going on ; as the bacteria themselves multiply, they seize upon the active soluble forms of nitrogen and convert them into insoluble proteins in their body tissues. Which action is predominant, will depend on the stage which has been reached in the dung-making process, *i. e.*, on the supply of carbohydrates, air, water, and other variable factors, but after the first rapid production of ammonium compounds the longer the dung is stored the more the ammonia returns to a protein form.

So far only the changes in the nitrogenous material of the excreta and the litter have been considered, since nitrogen is the chief fertilizing constituent of the manure, but the most characteristic change in dung-making is the destruction of the straw and its conversion into dark brown " humus," which in the end retains none of the structure, of the original straw. There are a number of organisms to be found commonly in the air and dust which readily attack such carbohydrate material as straw affords, and in the presence of oxygen burn it up completely into carbon dioxide, water and inorganic ash.

A considerable proportion, amounting to one quarter or more of the dry matter of the original dung, is lost during the process of humi fication, by the conversion of carbohydrates into carbon dioxide, marsh gas, hydrogen and water. No changes going on during the making and storing of farmyard manure are, it will be seen, exceedingly complex ; it is in the early stages that the bacterial actions are most rapid, and they fall chiefly upon the soluble nitrogenous compounds like urea. What the gardener calls " taking the fire" out of the manure means so reducing the free ammonia that the material is no longer injurious to a plant's roots, though it still remains rich in nitrogen and organic matter, capable of further decay. The "long" strawy dung begins to change to "short" or rotten manure, and this change may continue slowly for years, until all trace of structure is entirely gone and only a mass of brown pulp is left. Of

course, as the manure gets older and shorter, it becomes richer in nitrogen ; this apparent increase is, however, simply due to the loss of non-nitrogenous carbon compounds, so that the nitrogen, which does not waste, always bulks larger and larger in the residue.

One other change sometimes takes place when the manure is allowed to get too loose and dry ; instead of bacteria, fungi begin to develop very rapidly and the whole mass becomes permeated with mycelium. The masses of manure begin to look white and dusty, a condition which the practical man sometimes describes as "fire fanged." It is generally agreed that such manure is seriously deteriorated, but no analyses are available to prove this.—*The Canadian Countryman, Vol. IX, No.* 42.

XIII

Artificial Silk Industry In France.

The following extracts are made from an article which appeared in the *Journal of the Royal Society of Arts*, August 13, 1920, on the above subject.

The relative scarcity and high prices of silk and other textiles are at the bottom of a renewed interest that is being taken at present in the manufacture of the chemically-produced textile material known as artificial silk.

On account of the substance which it employs (wood), the new industry, developed by the Societe de la Viscose has been enabled to adapt itself to the climate. Favoured by groups of Lyon merchants engaged in the French silk and textile industries, it has become widely spread throughout the civilized world.

The production of artificial silk, which in 1902 was 4,408,000 lb., rose successfully to 11,020,000 lb. in 1906, to 13,224,000 lb. in 1912, and to 17,632,000 lb. in 1914.

Progress in the artificial industry was checked during the war, while at the same time the demand for its products was greatly augmented on account of the paucity of textiles. In spite of the fact that viscose silk is extremely inflammable and cannot resist humidity, uses for it were numerous during the war, to replace other materials ; and it was even found possible to make use of it directly in war work.

It is worth noting that the increasing activity of the artificial textile industry, far from coming into competition with that of the natural silk, coincides with and supplements the growth of the latter. The production of the natural silk increased from 41,876,000 lb. in 1904 to 50,692,000 lb. in 1906, to 59,508,000 lb. in 1912, and only dropped to 48,488,000 lb. in 1914 because of the war.

Viscose silk cannot be obtained in the really fine grades ; its use is restricted for the most part, to such uses as do not subject it

to fire and water. In short, taking into consideration that natural silks cannot supply the market, the artificial silk supplements the product, but does not compete with it except in the lower grades.

According to a report prepared at the United States Consulate at Lyons, a renewed impetus was recently given to the use of chemical textiles by the invention of an entirely new process, the product of which is called silk cellulose. This new form of cloth is claimed to possess a remarkable solidity and durability; it is no more endangered by fire than the ordinary natural silks. While the threads of the Viscose silks are, of necessity, relatively coarse and thick, the new silk permits of making threads of considerable fineness, and is particularly remarkable for the quality of the velvets which can be made from it. The new process differs radically from the old processes. Instead of converting a thick liquid (the viscose) into thread, it appears that it is possible to preserve the wood fibres and convert them into a brilliant and solid cellulose.

Despite the fact that for years to come the artificial textile may not compete with natural silk, yet the producers of the latter must eventually look for advances and inventions on the part of chemist that may ultimately remove the defects now so obvious in the viscose silks. What is most needed is ability to spin a much finer thread, which is at present extremely difficult on account of the air which is held in the coagulating bath in which the artificial threads are formed. Seven or eight years hence, when there has been time for a surplus of artificial silk to accumulate on the market, by reason of the establishment of new plants and increased production of other textiles, those whose interest is bound up in the artificial silk industry will be forced to bring about a new development in order to enable it to hold its place; at that time real competition may be looked for between natural and artificial silks.—*The Agricultural News, October* 30, 1920.

XIV

Building up a Dairy Herd.

BY

J. A. McClary

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There are two fundamental points to bear in mind particularly in starting to build up a good, healthy, productive dairy herd. First, to see that the best females possible, of the particular breed which you choose to work with, are procured for a foundation. They should have plenty of size, good, robust constitutions, carrying good dairy characteristics. They should be procured from good healthy

herds which are under regular inspection, and should be from dams and sires that have shown good results both as to the quality and quantity of milk produced. It is much preferable to have two or three really good individuals to start with than to start with a large number not up to the standard. The sire to be used in building up a herd is a very important factor also, as the sire is always considered over 50 per cent of the herd. As we said in regard to females, the sire should come from a good healthy herd with record performance behind him, having sufficient size, and carrying all the strong characteristics of the breed which he represents.

Secondly, after having a foundation laid, the next step is to see that proper quarters are provided for the housing of the herd, that is, a stable having plenty of light and ventilation. The herd should also be supplied with the proper food to develop them and to produce the largest amount of the best quality of milk at the cheapest price possible.

Another important point is the attention given to the rearing of the young calves. The following method has proven very satisfactory: Remove the dairy calf at birth. Do not allow him to nurse. Give mother's milk at the rate of 8 to 10 pounds, divided into three feeds for the first ten days, then start replacing with skim-milk so that at the age of one month the calf will be receiving 10 pounds of skim-milk with the addition of a small quantity of a scalded flax-seed meal. At three weeks of age a small quantity of oats, clover hay and some clean water should be kept before it from this time on, and the skim-milk should be gradually increased so that by the time the calf is 15 weeks old it will be receiving from 15 to 20 pounds daily.

Any person starting out to build up a good, profitable dairy herd cannot do so and know what he is about without the use of the Babcock test and scales. The dairy farmer should know just what amount of milk each cow gives throughout the year and the number of pounds of butter fat the milk contains. Any one who has not followed this practice is bound to get many surprises after following it for a year. The cow that has been considered one of the best producers in the herd may be found to be not doing more than paying her board. Cow testing not only produces better cows, but enables the dairy man to feed more intelligently. Get rid of the poor cows, carefully feed the good ones, breed them to a pure-bred sire, and the result will certainly be a large-producing and profitable dairy herd.—(*The Canadian Countryman, October* 23, 1920).

XV

The Edible Date.

(*Phœnix Dactylifera*)

This fruit tree is self-sown in Sind. The climatic conditions prevailing in the greater part of the province, that is to say, that part which is free from sea breezes, are almost identical with those of the well-known date-growing tracts of the world. The tree, as is well-known, requires a dry atmosphere, low humidity, high mean temperature, and very little or no rain. The slightest precipitation at the time of flowering spoils pollination while, during the ripening stage of the fruit, it sets up fermentation in the berries. "High temperature during the fruiting season is an essential requirement. The ripening of early varieties occurs when the mean temperature is above 70° F. and for one month at least above 80° F., that of moderately late varieties when it is above 75° F. and 85° F., respectively, and that of the best and latest when it is above 84° F. and 94° F., respectively. Besides these temperatures in the shade, the tree needs to be exposed to the direct rays of the sun for its growth."

Soil.—Sandy loam is perhaps the best medium for the successful growing of the date palm, but it is not uncommon to find it flourishing in heavy clay and even in salt soils. Slight alkali of the white type does not seem to be injurious to full grown plants, but young seedlings will not flourish if more than a trace is present.

Propagation.—Transplanting of suckers is the most general method of propagation. Round about the palms several off-shoots spring up and grow as a natural means of replacing the parent. Young off-shoots of from three to five years of age are removed and transplanted. Propagation by sowing the seed is not practised for reasons which are easily explained. These reasons are :—

(1) That most of the seedlings resulting from planting seed turn out to be males, and

(2) That the few female seedlings that remain do not carry the characteristics of the parent. The off-shoots are removed, as has already been stated, when they are about three to five years old. Large leaves are cut off but the growing bud is well protected. Transplanting takes place in April when the temperature becomes favourable to growth.

Field Operations.—After levelling the land, channels four feet wide are dug about twelve feet apart. Holes are made along one side of the channels twelve feet to fifteen feet apart. Twenty to thirty pounds of cattle manure are incorporated in the excavated earth, which is then returned to the pits. Irregular plantations are very common and testify to the self-sown existence of the palm.

Irrigation.—For the first three years after the date of transplanting, irrigation is regularly given. During the first quarter, *viz.*, April, May and June, well water is applied every alternate day in order that the seedlings may strike root. From July till the end of the year weekly irrigation is given. The sub-soil water is within twenty-feet from the surface and thus it is in easy reach of well established plants. Irrigation during the fruiting season is a necessity but it is carefully avoided during flowering (February—March) as it prevents the proper setting of the fruit.

Maturity and age.—In specially good soils young off-shoots begin to yield from the sixth year of their age, but ordinarily the eighth year is considered to be the average year, from which an appreciable quantity of fruit should be obtained. The palm is said to live at least two hundred years.

After-treatment.—Old leaves and dry fruit-stalks are removed every year just a little before flowering to keep the palms clean and allow more space to the new spathes. Direct manurial or intercultural treatment is not given, nor is it advisable, but the intermediate spaces are ploughed and manured to grow vegetable crops, seedlings of fruits, etc. A yard round each palm the earth is compressed and a mound raised to make the plant stable enough to stand the high winds which are common.

Flowering.—The date palm flowers in (March–April). Male plants produce stout club-shaped spathes which are enclosed in sheaths. The sheath splits up after about a week, exposing a fruit-stalk full of slender branches bearing innumerable flowers. These flowers are highly scented and possess some sweet substance (nectar) to attract bees and other insects which carry over the pollen grains to the female plants in the natural course of events. But this method of pollination is always defective, inasmuch as some female spathes split much later than the male spathes, in which case the pollen may be lost. The growers therefore remove the male flowering spathes just a little before splitting and insert one or two branches in each female spathe when it splits. The male inflorescence keeps a long time, if it is carefully stored. Experience has proved that for every one hundred female plants two male plants would be necessary, and therefore the ratio of one in fifty must be maintained. About three months after the pollination two of the three young fruits produced by each fertilized flower fall off and a single date is thus left to ripen from each flower. In the case of non-pollination, all the three fruits remain on the stalk, but they never develop the seed and are consequently of no value. Each palm produces from ten to thirty fruit stalks, all of which are allowed to bear in ordinary varieties. In better varieties, however, ten spathes only are allowed to fruit, the rest being cut off to enable the plants support the development of the remaining fruit to their maximum capacity.

Fruit.—The fruit appears in the market in three shapes, *viz.*, *Khasoon*, *Luni-kharkun*, and *Vanpakyun*, representing three distinct stages of its development. In the primary stage dark green dates quite unripe and acid in taste termed *Khasoon* are picked mainly with the object of lightening the weight of the branches. They are made edible by keeping them in closed earthen jars in a hot room for a night. This treatment of the unripe fruit tends to ameliorate the acidity of the dates and makes them fit for human consumption. The appearance of these in the market marks the advent of the date season. Seedless *Khasoon* are as already stated the unfertilized ovaries. In the secondary stage, the dark green colour changes into golden yellow or red, according to the varieties, when the dates are termed *Doka*. These are sold in the market either as *Doka* or are converted into soft, sweet dates termed *Luni Kharkun*. The latter are prepared by shaking one maund (80 lb.) of *Doka*, to which half a pound of common salt and three pounds of water added, in earthen jars, for about two hours in the evening. The jars are then placed in a close room for a night and emptied the following morning to dispose of the contents. Shortly after the appearance of *Luni-Kharun*, *Van Pakyun* begin to arrive in the market. The *Duka* turn into soft sweet dates, red ones producing black dates and the yellow results in deep yellow or brown dates. These are eaten as fresh dates or are dried. The fruit season lasts from 15th May to 15th October. *Van Pakyun* means ' ripened on the tree,' while the *Luni Kharkun* means 'treated with salt'.

Yield.—Full-grown palms bear, as already mentioned, from five to thirty spathes, but ten bunches may be taken to be an average production. Each bunch yields from ten to forty pounds of dates. The total yield per plant therefore ranges between one hundred to four hundred pounds or roughly one maund to five maunds. Calculating at the cheapest market rate of Rs. 3 per maund, the produce of a tree will fetch from Rs. 3 to Rs. 15. An acre of date palms (about two hundred palms) thus yields from Rs. 600 to Rs. 3,000.

Pests and diseases.—Parrots, sparrows, wahio and crows are common bird pests. Covering the bunches with mats and hanging old shirts on the palms which shake in the wind and frighten the birds, are the usual contrivances adopted to check these pests. Earthen balls are also shot through bows to drive the birds out of the plantations. No other fungus or insect disease is known to occur in the locality of Shikarpur. Solitary dead palms testify to the existence of the well-known Rhinoceros beetle which destroys the apical bud and kills the palm. But this is very rare.

Uses.—All parts of this palm except the roots are usefully employed. The long trunk is used in ' persian wheels' and other temporary structures. Fans, mattings, brooms and baskets are made by weaving the leaflets. Whole leaves are beaten down to fibre with wooden hammers and twisted into well ropes. The dried fruit

stalks serve as brooms, while the shaft of the stalk is split into long strips which are woven into bird cages. The fibrous material which forms the sheathing piticle of the leaf is used for making *Kabar* ropes and stuffing pack saddles. The soft portion adjoining the growing bud is removed from such palms as are cut down as useless or from the superfluous suckers and sold in the bazaar as *Tarmagzi* which is eaten raw. There is nothing very inviting in eating the material but as a novelty the hawkers get many customers especially among small children and boys, to make money out of the material, the extraction of which has cost them much energy and time.—*Bull No. 98 of Dept. of Agric., Bombay.*

XVI

Planting Sugar-cane between Two Rice Crops.

Preparation of the Soil.

In this article I shall describe our method of planting sugar-cane crop between two rice crops, and shall make some remarks about the principal points, to call attention thereto. Although I shall describe things relative to our Java culture, your readers may have some interest in the above mentioned subject, and find some useful hints of value to them. Conditions peculiar to Java are cane culture on fields rented from the natives (one cane crop, mostly within three years on the same field), replanting the cane for every new crop (no ratoon crops) and planting the cane between two rice crops.

About the labour question I can write that thereto we have had rather cheap but no superior labour by the natives.

The principal point requiring attention in planting cane after a rice crop, is the preparing of the soil before planting the seed cane. This is due to the usual inundation of the rice fields, the soil has been reduced in quality and has become sticky. Hence the aeration of the soil in order to oxidize and change its structure is one of the necessities in this case.

Condition of the Land after a Rice Crop.

The condition of the soil after rice has been cut is so bad that, even before replanting rice, it has first to be drained dry in order to obtain a sufficient amelioration of its structure and chemical properties. The soil of a rice field, which has been flooded for about four months, has become so sticky that even rather sandy soils look like heavy clay grounds. When the water-supply has been shut off and the water drained from the surface, the ground begins to crack open after two or three days' drying in the sun. The soil on the surface will contract, due to the withdrawing of the moisture, while the under soil is still moist, by which the surface will burst and crack open.

When such a soil, which has been absolutely dried at the surface, gets a sufficient shower, it will become arable at once. But a slight irrigation will do the same. In the above-mentioned cracks or clefts the air can penetrate into the soil and it will come into good condition.

Reduced Soils.

Reduced soils are soils which contain a deficit of oxygen. This does not mean free oxygen, as in the air mixture, but chemically fixed oxygen in its inner structure.

When the soil is shut off from the air by water, the anaerobic micro-organisms will multiply and the oxygen which they want for respiration they will not only take from the absorbed air in the flooding water but also from the oxidized earth substances and organic matters.

When the soil is planted and particularly with water plants, their roots will do the same. When the flooding water is continually renewed this water will supply the soil with a little of its absorbed oxygen, because flowing water will dissolve the oxygen from air much quicker than stagnant water. It is for this reason that stagnant water is disadvantageous to growing plants, even to rice, (exclusive of real water plants).

Thus the soil of the flooded rice fields will become reduced ; that means the oxidated earth particles will become sub-oxyds and the organic matters are transmuted into poisonous organic-acids and bodies which contain proportionally more carbon in their chemical structure.

But besides the deficit of oxygen, the structure of reduced soil will be sticky, by the presence of colloidal earth substances.

Oxydization of the Soil.

The oxydization of the soil we call in Java " uitzuring", which means literally " outsouring". Thus is effected the transformation of the acids in the above-mentioned reduced soils to neutral chemical substances, which will not be poisonous for plant life. But the process of " souringout" the mould, includes at once oxydization of the soil and the physical amelioration of its structure. All the above-mentioned alterations in the soil will be possible when the air can penetrate between the earth particles. This will be effected when the soil once has been absolutely dry.

When the soil becomes dry, the air will penetrate into the capillaries from which the water has been withdrawn and by the withdrawing of the water deflocculated earth colloids will shrink ; the soil will lose its sticky appearance and the structure will become " crumby".

By the penetrating of the air into the soil the aerobic micro-organisms will multiply and by this kind of bacteria and fungi, useful physical and chemical changes will be brought about. This will act on the organic acids and reduce them to carbonic acid and water. The insoluble partly carbonized organic remains will be changed to substances useful for plant life while the reduced earth substancer will be oxidised.

In order to flocculate the earth-colloids thoroughly, the soil must once have been quite dry, but afterwards it is advisable to moisten the soil slightly a few times in order to increase the action of the micro-organisms.

Available Substances in the Soil.

As already mentioned the Java soils are usually very fertile. The flooding of the fields during the periods that they are under rice, brings down in suspension finely divided soil, which affords a supply of potash and phosphates. The principal drawbacks of the continual flooding are the temporary reduction of the soil and its bad structure, but after oxidation, such a soil is as fertile as ever ; indeed the flooding of the fields may be considered as a permanent amelioration of the soil.

Repeated experiments in Java have shown that under conditions here prevailing, manuring with readily available nitrogen alone leads to the best financial results.

Pen manure is not only considered as a supply of readily available plant-food, but also as a matter useful to ameliorate the structure, especially of heavy soils, and to inoculate the soil with useful aerobic micro-organisms. Readily available nitrogen not only acts as plant food, but also stimulates the plant to absorb more of the other available substances. The former current opinion that continual intensive cane culture with the addition of much available nitrogen-manure will drain the soil absolutely of its food substances, has been refuted by numerous experiments annually carried out on Java *sawah* grounds. (Sawah grounds are the flooded fields whereupon rice is cultivated). The abovementioned opinion proceeds from the appearance of the rice fields after a cane crop. In such a rice field will be seen rows of extra green and luxuriant growing rice plants just following the former cross-ditches between the cane beds, by which the conclusion was drawn that on places where formerly cane has been growing, the rice is very bad and that only for the cane crop it would have been just as good as on the site of the former ditches when no cane has preceded it. Long continued experiments have proved that the above-mentioned fact was due to the insufficient tillage of soil by the Javanese farmers. They plough the soil too shallow while they fill the cross-ditches of the former one filled with the fertile oxidised supersoil, and of course the rice on these ditches will grow vigorously.

The harvested cane fields, which are returned to the Javanese owners before the rainy season, and which they first plant with cow-pea and India corn or sometimes other crops, will generally give a better rice crop afterwards on account of the better oxydization and double tillage of the soil.—(*Indian Scientific Agriculturist, Vol.* 1, *December* 20.)

XVII

The Bassia or Mowra Tree.

There are very few plants of which the corolla forms a valuable article of food for millions of people. One such plant, however, is the Bassia or Mowra tree of India. This tree belongs to the same botanical order (Sapotaceæ) as several well-known West Indian trees, such as the sapodilla, the star apple, and the " mamme sapote." An interesting article on this tree and its products appeared in the Bulletin of the Imperial Institute, July-September 1919, from which the following is chiefly taken :—

Of the three species of Bassia commonly met with in India, the principal one is *B. latifolia* (Roxb), indegenous to the forests of Central India. It is known by the vernacular names of ' mowra ', " mohua " " mohowa " and ' mohwa.' In South India and Ceylon its place is taken by *B. longifolia* " which is put to the same economic uses." The third tree is *B. butyracea* of the sub-Himalayan tract, known as the Indian butter tree.

The seeds of these trees yield an important commercial product in the form of the valuable edible fat known as Illipe butter, largely employed by the natives as a food-stuff. Before the war the export of seeds to Europe was considerable, being mainly utilized in Germany and Belgium for the manufacture of margarine, soap, candles, etc.

Amongst the native population of India the chief importance of the mowra tree lies in the flowers, which are rich in sugar and highly valued as a food-stuff and as the source of a spirituous liquor. Some conception of the value put upon the flowers for these purposes by the natives is gained from the estimate made thirty-three years ago that, in the Central Provinces, over 1,000,000 people used the corollas of the mowra as a regular article of food, each person consuming about 80 lbs. per annum. In the Bombay Presidency they are also used for domestic consumption on a large scale and throughout India they are looked upon as a valuable reserve in famine years. The flowers of *B. butyracea* are not eaten, but a syrup prepared from them is boiled down, yielding a sugar about equal in quality to date sugar.

The mowra tree, sheds its leaves in February, and the flowers appear in March and April, at which time the ground beneath the trees is carefully cleared.

The flowers have a thick, juicy, globeshaped corolla of a pale cream colour, enclosed at the base in velvety chocolate-coloured calyx. The corollas fall in the early hours of the morning and are collected by women and children. They are spread out to dry on mats in the sun, when they wither to half their weight, and develop a brownish-red colour. In some cases the flowers are collected before they drop, and in many places it is the practice to remove only the corollas, leaving the pistil to ripen as fruit. A tree will yield 200 to 300 lbs. of flowers in a year.

When fresh, the flowers are extremely sweet, with a peculiar pungent flavour and a characteristic odour.

When dry the peculiar pungent flavour is less perceptible, particularly if the stamens are removed, and the flavour then resembles that of figs. The flowers are eaten either fresh or dried, and cooked in many different ways, with sal seeds, rice, shreded cocoanut, or flour.

The greater portion of the crop of flowers is used for the preparation of daru or mowra spirit. The native spirit has an offensive butyraceous odour, and is rich in fusel-oil, one sample examined containing 3 per cent of fusel-oil. In England it was found that over 6 gallons of proof spirit could be obtained from 1 cwt. of the flowers.

The composition of the flowers has been investigated at different times, and, the total amount of sugar recorded in the flowers of *B. latifolia* varies from 40 to 70 per cent. The quantity of cane sugar recorded varies from 3 to 17 per cent, and that of invert sugar from 40 to 53 per cent.

Thirty years ago attention was directed to the richness of the Bassia flowers in sugar, and the possibility of their being used in India as a course of sugar for export ; but when it was established that except for a very slight proportion, the sugar was uncrystallizable, and therefore of little value except perhaps as a brewing sugar, the interest from this point of view died down.

During the war the interest was centred in the production of acetone from Bassia flowers in India to supply the local demand in connection with the manufacture of munitions, and it has been alleged that the yield from the flowers of *Bassia latifolia* was one-tenth of their weight or nearly ten times as much as is obtainable by distilling wood. The demand for acetone in India in peace times would not be large enough to justify the available supplies for flowers being entirely devoted to the manufacture of that product, but there remains the possibility of their being used for the manufacture of industrial alcohol. Derived from a forest tree the other products of which are also of considerable economic value, they appear to represent an exceptionally cheap source. The yield of alcohol from the flowers is high compared with that from potatoes and other

materials commonly used. It has been stated that about 90 gallons of 95 per cent alcohol is obtainable from 1 ton of dried flowers.

In view of the extended use that is now being made of alcohol for power purposes, it seems likely that the most profitable way of utilizing the flowers would be as a source of a mixed motor spirit of the ' natlite ' type for local use in India.

It has been computed that, in Hyderabad at least, the total cost of collecting and drying the flowers and delivering them to a factory in the zone of growth amounts to £ 1 10*s.* per ton.

It has been estimated that, in the Hyderabad State alone, there are already sufficient Bassia trees for the production of 700,000 gallons of proof spirit per annum in addition to that necessary for the local liquor requirements.

In addition to the question of the production of alcohol from the flowers, and the value of the seed as a source of oil, the flowers form a valuable food for the natives, particularly in famine years. The tree is well adapted to withstand drought, and is specially suited for planting on dry and waste lands, where little else will grow.

The tree takes about twenty years to produce flowers and seeds in large quantity, but during this period the land need not be entirely unproductive if interplanting were adopted at first. Experiments conducted in Assam during the past ten years have shown that, owing to the long tap root, the Bassia seedlings do not transplant well, and therefore the seeds should be planted 'in situ.'

From the above description of this Indian tree, it seems to be possibly a desirable plant for introduction into other tropical countries.—*Indian Scientific Agriculturist, December*, 1920.

Statement showing the Districtwar Abstract of the Fifth Quinquennial Census of Agricultural Stock taken in January, 1921 as per G. O. No. R. 4140—99 R. M. 7—20—9, dated 22nd September, 1920, in the Mysore State.

Serial No.	District	Year	Oxen				Buffaloes			Sheep	Goats	Pigs	Horses and Ponies			Mules	Donkeys	Camels	Ploughs			Carts
			Bulls	Bullocks	Cows	Young stock (Calves)	Male Buffaloes	Cow Buffaloes	Young stock (Buffalo calves)				Horses	Mares	Young stock (Colts and fillies)				Old pattern	New pattern	Total	
1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
			(a)			(b)								(c)			(d)					
1	Bangalore.	1916	7,008	177,100	257,700	155,588	7,176	47,740	..	288,848	341,448	information not available.	..	3,446	..	..	12,481	4	109,988	1,079	111,067	36,018
		1921	**28,879**	**150,853**	**283,392**	**124,837**	**7,612**	**53,742**	**30,308**	**264,726**	**228,334**	**4,001**	**2,038**	**1,886**	**158**	**93**	**12,437**	**2**	**112,082**	**1,963**	**114,045**	**34,513**
2	Kolar ..	1916	2,647	197,715	190,632	132,086	15,099	60,426	..	601,961	292,175	..	..	2,472	..	..	11,732	1	97,714	201	97,915	31,995
		1921	**50,990**	**141,826**	**189,546**	**95,297**	**14,092**	**63,008**	**35,180**	**508,964**	**219,299**	**7,102**	**1,232**	**1,224**	**100**	**14**	**11,913**	..	**93,593**	**696**	**94,289**	**29,608**
3	Tumkur ..	1916	2,486	218,922	191,429	154,280	17,358	51,550	..	708,973	343,869	..	..	2,594	..	..	8,453	..	115,675	282	115,957	28,114
		1921	**33,763**	**197,810**	**223,351**	**144,424**	**18,089**	**56,129**	**38,278**	**689,504**	**228,990**	**5,661**	**1,262**	**1,535**	**214**	**25**	**9,432**	**3**	**118,363**	**654**	**119,017**	**28,662**
4	Mysore ..	1916	5,995	333,120	399,761	231,792	10,584	76,449	..	745,966	429,041	..	..	3,233	..	..	8,610	60	208,871	322	209,193	63,537
		1921	**52,277**	**309,449**	**423,797**	**210,731**	**12,768**	**134,805**	**42,590**	**698,162**	**306,634**	**6,465**	**1,491**	**1,803**	**229**	**8**	**8,937**	**37**	**214,483**	**585**	**215,068**	**60,710**
5	Hassan ..	1916	3,506	218,510	217,570	148,903	8,514	57,535	..	285,963	126,935	..	..	2,535	..	..	2,236	..	110,227	215	110,442	16,466
		1921	**23,118**	**192,276**	**222,606**	**131,807**	**9,517**	**55,544**	**28,999**	**267,123**	**90,524**	**10,197**	**978**	**1,212**	**113**	**15**	**2,396**	..	**107,239**	**492**	**107,731**	**16,481**
6	Shimoga..	1916	2,852	193,156	135,244	184,875	24,051	67,852	..	33,017	62,247	..	..	1,273	..	..	890	.	87,100	197	87,297	34,888
		1921	**38,627**	**156,298**	**147,649**	**145,553**	**23,677**	**64,822**	**44,576**	**32,555**	**41,241**	**3,152**	**537**	**560**	**33**	**2**	**1,161**	..	**79,662**	**594**	**80,256**	**31,540**
7	Kadur ..	1916	2,880	133,917	106,478	99,830	10,414	39,557	..	68,043	48,559	..	..	979	..	..	1,981	2	59,830	265	60,095	14,380
		1921	**22,934**	**110,785**	**105,291**	**80,508**	**11,274**	**35,481**	**19,614**	**71,817**	**42,747**	**8,399**	**402**	**421**	**30**	..	**3,199**	..	**57,139**	**634**	**57,773**	**13,140**
8	Chitaldrug.	1916	2,062	181,363	111,937	129,640	14,479	85,103	..	348,376	191,214	..	..	2,485	..	..	5,516	2	81,237	679	81,916	28,005
		1921	**34,221**	**152,896**	**121,524**	**84,045**	**16,872**	**90,660**	**61,997**	**331,435**	**124,922**	**2,535**	**1,241**	**1,456**	**151**	**1**	**5,639**	**6**	**76,446**	**1,144**	**77,590**	**27,223**
	Total .	1916	29,436	1,653,803	1,610,751	1,237,294	107,675	486,242	..	3,081,147	1,835,488	..	..	19,007	..	..	51,899	69	870,612	3,240	873,882	253,403
		1921	**284,809**	**1,412,193**	**1,717,156**	**1,017,202**	**113,901**	**554,191**	**301,542**	**2,864,286**	**1,282,691**	**47,512**	**9,151**	**10,097**	**1,028**	**158**	**55,114**	**48**	**859,007**	**6,762**	**865,769**	**241,877**
	Difference ..		..	..	..	+106,405	..	+6,226	+67,949	..	−216,861	−552,797	..	..	..	..	..	..	−21	−11,605	+3,522	−8,113	−11,526

(a) The figures under the column for 1916 include only breeding bulls, the other breeds being included under bullocks column while those for 1921 include breeding bulls as well as other bulls.

(b) The figures under this column for 1916 include buffalo calves also, while buffalo calves are shown separately under column 9 for 1921.

(c) Separate figures for horses, mares and ponies are not given for 1916.

(d) Mules as well as donkeys were clubbed together in 1916.

OUR QUERY COLUMN.

SILAGE IN THE HEBBAL FARM.

Letter No. 1338, dated 2nd June 1921, from the Live Stock Expert in Mysore, Bangalore :—

" In response to your enquiry, I give herewith for the benefit of your readers with regard to the silo pit and resultant silage made at the Hebbal Experimental Farm during the past season.

A circular pit 10′ x 25′ deep was constructed and filled with Indian corn (Zea mais) during September of last year. The corn was cut with a climax chaff cutter, driven by the power from an Austin tractor, and allowing for stoppage, not more than three days was occupied in filling it. The total green weight put in the pit was 37,711 lbs.

On account of the slow supply of corn, which was nearly all obtained by purchase, and of a further combination of wet weather and improper handling of the green corn, a certain amount of it started to mould, and was put in the silo long to prevent further spoiling. This was done with a certain amount of hesitation as it was feared that sufficient air would be imprisoned with this material to allow of further mould growth, but the cut material put in afterwards was worked into it as much as possible by tramping. The cut material was cut into lengths of about one and a half inches, and during the time of filling a man was kept in the pit tramping the material to pack it. On completion, the whole was covered with gunny bags and about six feet of earth heaped over it, which was added to as the heap settled, so that no depression was left for the collection of surface water. On account of the fact that long stalks had been put into the pit, the settling was considerable, and an extra weight of soil was put over the pit to cause this settling to take place as rapidly as possible.

The pit was opened in April 1921, and after a small surface layer of about 4 inches of dry and soiled silage was removed, the remainder was found to be in excellent condition, and was instantly relished by the cattle, even calves, a few weeks old, ate it with *gusto*. The long stalks were quite good and consumed " in toto ", without being cut, no butts or particles being left as is the case with similar material dried. A small portion, round the edges, was slightly spoiled and not so much relished by the cows, but the buffaloes ate even this greedily. Provided that material can be found, it is intended to repeat the making of silage this year, and on a larger scale.

The deep form of silo pit was adopted in order to insure pressure, which is more easily obtained in such a pit, and is essential to the

manufacture of good silage, but it is conceivable that such a pit would not be practicable in all cases, as for example where the water table is high, or where a rocky bottom is met with. In order to ascertain the degree of success to be met with in shallow trench silos, we hope to construct a trench silo this year, if material is available.

As for the crop used ; in this case corn was used as it was more readily available, but some other crops would do just as well, notably Jola. Cowpea in conjunction with jola will be tried this year. In all cases a proper compression and exclusion of air is essential, which is easily obtained if the material is well tramped when being ensiled and a sufficient depth of earth put over the whole thing on completion. I may add that there is still some silage left in the pit at Hebbal, which is being fed daily, and any one desirous of seeing this, may do so during the next two or three weeks, after which the silage will become exhausted. If any members of the Union would care to prepare a trial silo for themselves during this year, I will be only too glad to render what assistance I can."

The Mysore Agricultural & Experimental Union, Bangalore.

NOTIFICATION BY THE PRESIDENT.

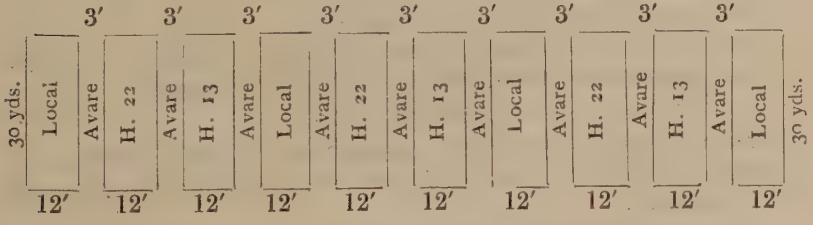
Ragi (*Eleusine Corocana*) Varietal Tests.

The object of these tests is to find out more productive types of ragies than the present ones for every portion of the State. The selection is not only for good yielders but also for drought resisting ones. To get reliable results much care is needed to conduct these trials.

A fairly level field with a uniform soil and good drainage are the first requirements. It would be better to select a plot which had one type of crop all over in the previous season, and had received uniform treatment. Subsequent cultivation and manuring for the present crop should be also uniform. The present crop of *ragi* must be sown pure but in the space between each variety a line of *avare* (lab-lab) may be sown.

Generally a twelve tyned drill is used for sowing. The breadth is 4 feet, each tyne being 4 inches apart. Seed rate per acre with such a drill varies between 5 seers to 10 seers per acre according to the skill of the sower. Sowing a length of 91 yards or a length of 30 yards three times with such a drill, one could cover an acre of nearly $\frac{1}{40}$ acre or one *gunta* of land. A correct knowledge of area sown is essential to calculate the yields of grain and straw at the harvest time.

To make allowance for the variations in soil fertility, the seeds should be sown at least in three separate plots. A local variety must always be sown along with the improved ones to compare the results. The following plan will be very useful in conducting the experiments.



N.B.—(When more than two types are used, have the local type after every two varieties and repeat the whole series thrice. The series should always begin and end with plots sown with the local type).

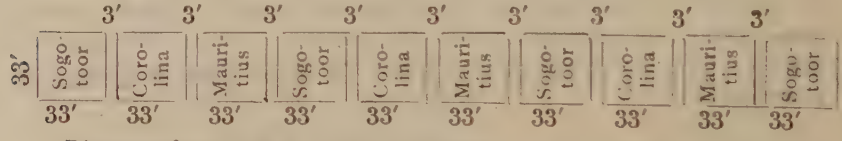
Yields of each plot should be harvested, stacked and threshed separately. Average yields of these plots will give a fair knowledge about the relative merit of each variety. Such results obtained for at least 3 years will be highly useful for picking out the best type for each area.

Caution.—Seed drill should be in good order. It should be cleaned thoroughly after every variety is sown. Mixtures of other types of *ragi* plants should be removed before they are ripe. After threshing every type the floor should be cleaned.

Ground-nut (*Arachis hypogeæ*) Trials.

Many varieties are now in cultivation ; but all of them are not good yielders. Bunch varieties of small Japan and Spanish are good enough as early ripeners and fit for places where labour is not available ; but they are poor yielders. Trailing type Virginia is becoming popular on account of its big pods. But the crop being a commercial one, to get the biggest profits, only those that are best fitted for each locality and yield heavily, should be grown in every place.

The field for conducting the experiment should be level and have either loamy or sandy soil. Drainage should be good. Heavy and water-logged soils are not suitable for this crop. The whole field must have been cropped with one type of crop in the previous season. The minimum size of each plot should be one *gunta* in area or 33′ x 33′. To make allowance for the variation in the soil fertility each type should be sown at least in three plots. The local *Sogatoor* variety may be taken as the standard type and the others compared with it. At least a spacing of 3 feet should be given between each plot or else the varieties get mixed owing to the trailing habit of the plant. The following plan will be useful for sowing and for laying out the plots :—



Distance from row to row = 6 inches.

Seed rate :—Seed about 130 lbs. per acre or 3¼ lbs. per *gunta* or pods about 170 lbs. per acre or 4½ lbs. per *gunta*.

1 lb of pods measure roughly 1 seer.

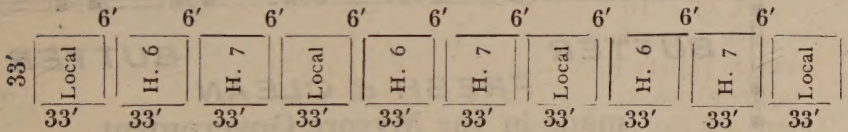
About 15 seers of pods are just sufficient to sow 3 *guntas*. If the rows are laid out a foot apart the seed rate will be nearly half of this quantity.

If the Agricultural Inspector is informed beforehand, arrangements will be made to give help at the time of harvesting. Results of Ground-nut experiments are published in the Mysore Agricultural Calendar, 1921.

Castor (*Ricinus communis*) Trials.

There are a large number of castors now under cultivation. The varieties vary from tree-castors to early ripening dwarf-types possessing different grades of seeds. The oil has a good demand and with the extension of the areas under money crops like sugar-cane the demand will increase for the rich oil-cake for manurial purposes. A large number of castors has been tested on the Hebbal Farm and from plant selections made out of the best types high yielding strains have been evolved. Some of them have done very well on the Government Farms and on some private estates. Before distributing these new strains for general cultivation they require to be tested in different places for selecting the best for each area.

Any well-drained arable soil will do for this crop but the yields will be proportional to the fertility of the soil and the amount of care paid to it. It should be sown in rows 3 feet or 4 feet apart. Distance between plants in the row should be about 2 feet. In between the rows legumes like *Avare* or Cowpea may be cropped. As the soil fertility varies between different parts of a field each variety must be sown in three plots at least. One of the varieties or a local castor may be used as a standard to check the others. Each plot should be at least 33′ x 33′ or one *gunta* in area. Between each plot a spacing of 6 feet should be given. The following plan will help to lay out the plots and to sow the seeds properly:—



Distance between rows in each plot 3 feet or 4 feet.

Inter-crop — *Avare* or cowpea.

Spacing between each plot 6 feet.

Seed rate about 12 lbs. per acre or about $\frac{1}{3}$ lb. per *gunta* plot.

As the capsules burst freely when they dry they must be removed often from the plants and preserved in separate bags to prevent mixing of varieties in the store room.

For threshing and taking weights and for other help write to the Agricultural Inspector of your place.

NOTICE

The Editor begs to announce for the information of members that the following Journals, etc., are now on our exchange list and are being received in the Journal Office regularly:—

The Journal of the Ministry of Agriculture, *London.*
The Agricultural Journal of India, *Pusa.*
The Tropical Agriculturist, *Ceylon.*
The Mysore Economic Journal, *Bangalore.*
The Planters' Chronicle, *Coimbatore.*
The Indian Scientific Agriculturist, *Calcutta.*
The Agricultural Gazette of Canada, *Ottawa.*
The Planter, *Kuala Lumpur, F.M.S.*
The Journal of the Mysore Engineers' Association, *Bangalore.*
Agricultural India Journal, *Moradabad* (Urdu).
Vokkaligaru Vokkalutanavu, *Dharwar.* (Kannada).
The Implement & Machinery Review, *London.*
The Agricultural Gazette of New South Wales, *Sydney.*
The Journal of the Madras Agricultural Students' Union, *Coimbatore.*
The Tropical Life, *London.*
The Modern Review, *Calcutta.*
Commerce and Industries, *Madras.*
The Agricultural Bulletin of the Federated Malay States, *Kuala Lumpur.*

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PLATE I

POTS MANURED ONLY WITH NITROGENOUS MANURES

28. Nitrate of soda 30. Sulphate of ammonia 34. Sunnhemp 40. Groundnut cake 42. Honge cake 46. Castor cake